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Compiling Air Toxics Emission Inventories

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16. ABSTRACT

This report contains technical materials that will assist state and local control agencies in compiling air toxics emission inventories. It contains a discussion of 1) various considerations that should be made in planning and beginning an inventory and 2) various tools an agency can use to locate potential sources and to estimate emissions therefrom. The appendices contain the data needed to use these inventory tools and some example applications of them.

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COMPILING AIR TOXICS EMISSION INVENTORIES

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EXECUTIVE SUMMARY

The purpose of this report is to offer assistance to those agencies getting started in compiling inventories of air toxics emissions. This compilation process may simply involve the development of a preliminary screening inventory or may involve the development of a more detailed and comprehensive inventory, depending on the needs of the agency.

This report is comprised of two major components. The main body primarily discusses those issues and concepts that should be taken into account during the planning stages of inventory development. The screening inventory concept is discussed and various procedures are presented that can be used to develop screening estimates of air toxics emissions.

The appendices comprise the second major component of this report. The appendices complement the general discussion by presenting that information needed to implement many of these screening tools, including source category/pollutant cross indexes, emission factors and apportioning factors. These appendices also contain examples of the use of each of the various screening tools as well as examples of several types of questionnaires and chemical name synonyms.

A major decision facing the agency regards what substances should be included in the inventory. This report does not recommend a specific list of compounds, but rather, presents a core list of pollutants that the agency may consider as a starting point. The 20 or so compounds on this list have been identified as important national contributors to cancer risk and aggregate incidence and/or are those substances for which EPA has set National Emission Standards for Hazardous Air Pollutants (NESHAPs) or may do so in the near future. In addition, a list of 64 substances is presented that 4 or more agencies have considered in their air toxics programs.

Many aspects of the air toxics inventory are similar to those of the criteria pollutant inventories already compiled by most agencies. Hence, basic procedures that have been published for compiling criteria pollutant inventories are not repeated herein. Instead, the emphasis is on providing the agency with the tools to build on the procedures and data used in the criteria pollutant inventory to complete the air toxics inventory. In this regard, the existing criteria pollutant inventory is a valuable starting point for compiling an inventory of air toxics emissions. Some emphasis is also needed on nontraditional sources, sources of non-photochemically reactive volatile organic compounds (VOC) such as methylene chloride and methyl chloroform, and certain sources of air toxics that were not considered as point sources in the agencies' criteria pollutant invntories.

CHAPTER 1

INTRODUCTION

Emission inventories have generally been compiled for use in criteria pollutant control programs in order to 1) provide summary information on sources and emissions, 2) help define source/receptor relationships and 3) develop and evaluate alternative control strategies. Emission inventories are now being developed and used in air toxics control programs for basically the same reasons.

Recent survey information collected for inclusion in EPA's National Air Toxics Information Clearinghouse data base indicates that about 15 States and 13 local agencies have compiled air toxics emission inventories in some form and that 25 more agencies are planning to do so in the near future. EPA is strongly emphasizing the development of State and local inventory and other data collection capabilities as part of its National Air Toxics Strategy.[1]

EPA has published procedures for compiling emission inventories of criteria pollutants.[2-7] Many of these same procedures will apply to air toxics emission inventory development and an agency's existing criteria pollutant inventory may serve as a good starting point for compiling the air toxics inventory.

The purpose of this document is to offer assistance to those agencies getting started in compiling inventories of air toxics emissions. This compilation process may only involve the development of a preliminary screening inventory or may involve the development of a detailed and comprehensive inventory, depending on program needs, resources and the nature of the air toxics problem.

This report is divided into two major parts. The main body (Chapters 1-8) provides a general discussion of the issues and concepts involving air toxics inventories. It advises States and local agencies of various considerations that should be taken into account when planning and compiling air toxics inventories. The following topics are discussed that are considered fundamental to any such effort:

- Anticipated uses of air toxics emission inventories
- Need for a screening study
- What substances to cover
- What source categories to cover
- Point/area source distinctions
- Geographic area of coverage
- Source location, data collection and emission estimation procedures

To complement this discussion, several appendices are included which present examples, case histories and other data useful in compiling air toxics inventories. The emphasis in these appendices is on presenting various screening mechanisms and other techniques for identifying pollutants of potential concern and for estimating emissions.

The contents of these appendices are summarized below:

- o Appendix A presents example applications of the various screening tools that are available to develop preliminary emission estimates.

- o Appendix B summarizes what various State and local agencies have done to resolve a number of important inventory issues.

- o Appendices C through G present a series of source category/pollutant listings, or cross indexes, enabling the user to associate potential pollutants with specific source categories. Appendices C and D present this association on a basis of Standard Industrial Classification (SIC) codes. Appendix E gives a verbal description of what industrial or commercial activities are defined by each four digit SIC code. Appendices F and G provide this source category/pollutant matchup on a descriptive, non-coded basis and are somewhat more definitive than the SIC-based cross indexes.

- o Appendix H presents a listing of emission factors for air toxics, linking emission rates with certain levels of source activity.

- o Appendix I presents a listing of apportioning factors for use in speciating VOC emissions. These factors are associated with Source Classification Codes (SCCs) used in EPA's National Emissions Data System (NEDS) and the Emissions Inventory System (EIS).

- o Appendix J presents an example of a general questionnaire utilized for air toxics emission inventories.

- o Appendix K presents an example of a production and use survey, sometimes used to determine which sources should receive more detailed follow-up questionnaires or to supply emergency response data.

- o Appendix L presents a glossary of chemical name synonyms for commonly inventoried substances, useful in interpreting data supplied by sources.

This report is primarily geared to helping agencies in the planning and screening portions of their air toxics programs. As such, (1) basic considerations are emphasized that the agency should take into account when planning the inventory effort and (2) simple tools are presented to help the agency make preliminary, screening estimates of source strength without having to make source contacts.

To some extent, the screening tools presented herein can be extended to provide more detailed emission estimates and to screen information provided by sources in permit applications. Also, the references cited in this report, and additionally in the EPA Clearinghouse bibliography,[8] will provide some of this support.

CHAPTER 2

ANTICIPATED USES OF AIR TOXICS EMISSION INVENTORIES

The paramount consideration in planning any inventory is how, ultimately, the inventory will be used in the agency's air quality control program. Since air toxics emissions data may also be used in water or solid waste programs or by other agencies, outside groups, and individuals, the needs of these other potential users should also be considered.

2.1 Uses of Air Toxics Emission Inventories

Various uses of air toxics inventories by State and local agencies are summarized in Table 1. Several of the more important of these applications are discussed below.

(a) Defining general source and emissions patterns

Air toxics inventories can be used for relatively undemanding purposes such as developing preliminary screening estimates for various source categories to help understand broad emission patterns and trends. For example, an agency may want the capability to determine the largest point source emitters of a particular substance in a given area, or determine the relative contribution of certain point and area sources. A screening inventory may help the agency focus on certain pollutants and sources in its detailed inventory. Or an emergency response program may desire the ability to identify whether certain chemicals are stored or used at various plants. These types of applications would not necessarily require the collection of extremely detailed source and emissions data or the development of a sophisticated data handling system to store and manipulate these data. This abbreviated type of inventory may not support detailed exposure modeling or risk assessment analyses, but would allow the agency to start defining its air toxics problem and prioritizing subsequent data collection activities. (Screening is discussed in more detail in Chapter 3.)

(b) Point source emission modeling

Many agencies use their inventories to provide input to various kinds of dispersion models for estimating ambient air concentrations around new and/or existing point sources. Typically, in this approach, these modeled ambient air levels are then compared with ambient air standards or guidelines (such as occupational exposure limits divided by a safety factor) to determine what control may be required. In this type of program, each source is generally evaluated as if it were an isolated emitter, without consideration of the aggregate effects of nearby sources.

In general, the kinds of data needed for modeling air toxics around point sources are the same as for criteria pollutants since, for most releases, air toxics are assumed to behave in the same ways as criteria pollutants. (Some

TABLE 1

POTENTIAL USES OF AIR TOXICS EMISSION INVENTORIES

1. To satisfy a legislative or other mandate

2. To identify sources and general emission strengths, patterns, and trends

3. To store data from related programs

   e.g. -- permit/registration/compliance data
   -- emergency preparedness data
   -- right-to-know data
   -- act as "tickler file" for permit review and enforcement actions

4. To site ambient air monitors

5. To provide input to point source dispersion models to predict ambient air levels

   e.g. -- to compare with acceptable ambient air levels (AALs)
   -- to determine maximum individual risks and aggregate incidence

6. To focus subsequent inventory work or other program development efforts

7. To identify multiple source and multiple pollutant problem areas characterized by high additive risk

8. To develop control strategies and regulations

Note: This list is not intended to be all inclusive. It reflects uses indicated by various State and local agencies and EPA.

accidental releases may involve such large quantities of heavier-than-air compounds that conventional Gaussian plume modeling may not be applicable.) Indeed, the same dispersion models (e.g., PTMAX, CDM, ISC) may be used in certain air toxics applications. To model point sources, detailed stack, exhaust (and sometimes building) parameters are needed as well as temporally resolved emission estimates. Different and more exacting source data may be required for modeling short-term releases than for projecting annual averages. The input requirements to each model will vary, of course, and cannot be summarized here. Various available models are described in References 9 and 10. EPA's modeling guideline, Reference 9, is expected to be updated and expanded in 1986. It should be noted that neither of these references explicitly covers air toxics modeling although some of the models therein may be applicable in certain situations.

Some models require more detailed source and emissions data than the agency may feel are reasonable to collect or estimate for all sources and all pollutants. In this situation, the agency may opt, instead, to prepare a detailed ad hoc inventory only in those special situations where complex modeling is necessary.

(c) Multiple source/pollutant assessment and control strategy development

A few programs are starting to go beyond individual point source assessment and are beginning to evaluate the impact of all sources of air toxics in some areas. To evaluate the impact of aggregations of point and area sources in an area, an agency must consider minor point and area sources as well as major point sources. Such assessments may entail the use of areawide dispersion and exposure models which require detailed source and emissions data for both major and minor point sources as well as spatially resolved estimates for area sources. The inclusion of minor point and area sources in the air toxics inventory requires more resource expenditure than just including major point sources. The use of air toxics emissions data in multiple source/pollutant assessments and control strategy development represents the most demanding use of these emission inventories.

2.2 Effect of Program Use on Inventory Complexity

Different levels of detail are needed depending on the anticipated uses of the inventory. Table 2 shows some of the inventory parameters that increase in complexity as the inventory applications become more demanding. Because this is such an important consideration, the agency should determine what uses the air toxics inventory will be put to at the outset of the inventory planning process. The important point is that the inventory agency must be aware of all of the projected uses of the inventory before commencing with data collection. In general, inventory design and data collection needs will be determined by the most demanding applications of the inventory.

TABLE 2

INVENTORY COMPLEXITY AS A FUNCTION OF APPLICATION

INVENTORY USE	LEVEL OF COMPLEXITY
LESS DEMANDING APPLICATIONS	SIMPLE DATA SUMMARIES
	AGGREGATED SOURCE DATA
	MAJOR POINT SOURCE EMPHASIS
	MORE SOURCE CONTACTS
	STACK AND EXHAUST DATA
	CONTROL EQUIPMENT TYPE AND EFFICIENCY
	SPATIAL AND TEMPORAL RESOLUTION
	INCLUSION OF MINOR AND AREA SOURCES
V	CONTROL STRATEGY SIMULATION CAPABILITY
MORE DEMANDING APPLICATIONS	COMPLEX DATA HANDLING CAPABILITY

(Note: Refer to Table 1 for various applications of air toxics emission inventories. In general, the applications in Table 1 become more demanding with increasing order of listing.)

2.3 Additional Planning Considerations

Several other considerations should be made in the early planing stages that will effect the usefulness of the air toxics inventory. These are discussed as follows.

(a) Actual vs. allowable emissions

Agencies typically include estimates of actual emissions in their inventories. Some agencies also include allowable emissions, perhaps as reflected in each source's permit. The inclusion of allowable emissions may be useful to the agency in certain modeling or control programs.

(b) Annual vs. short term emissions

Agencies traditionally have compiled estimates of annual emissions. Annual estimates of air toxic emissions are appropriate when the agency is evaluating potential cancer risks since carcinogenesis involves long term exposures. Shorter term emission estimates may also be useful for modeling short term, maximum concentrations around certain sources, such as when estimating acute health effects posed by certain pollutants. In addition, allowable emission limits may be expressed on a short term time frame.

(c) Accidental vs. routine (predictable) emissions

Agencies have generally only considered routine, predictable emissions in their inventories, i.e., those emissions that could be expected to recur in a certain time frame. Routine emissions would include continuous emissions, both process and fugitive, and intermittant emissions from scheduled, but discontinuous, operations (e.g., batch processes, startups, shutdowns and maintenance operations). Accidental releases would be short term and unscheduled and may involve events that are catastrophic in nature. Accidental events could involve control equipment failure or bypass, pressure relief, equipment openings and spills. There is a fine line between what some may consider irregularly occurring, but predictable, events and accidental events. The latter would not necessarily be expected to happen at every plant within a given reporting year and may be difficult to handle in a representative manner in the air toxics inventory.

(d) Process vs. fugitive emissions

Process, or stack, emissions have traditionally been the focal point of emission inventories. Fugitive emissions can be a very important component from some source categories (e.g., organic chemical manufacturing) and should not be overlooked. Important sources of fugitive emissions include material storage, loading and unloading operations, process valves, flanges, pump seals, open-ended lines, sampling ports, etc.

CHAPTER 3

PRELIMINARY SCREENING STUDIES

It may prove helpful as part of the planning process to conduct some sort of screening study before commencing with the detailed air toxics inventory. The general idea of a screening study is to develop preliminary estimates of emissions and associated risks in order for the agency to focus its program and resources on the most important sources and pollutants. EPA's "Six-Month Study" is an example of a national screening study conducted to evaluate maximum individual lifetime risks, additive risks and aggregate cancer incidences.[11] Table 3 contrasts the features of the screening and detailed emission inventories.

3.1 Screening Considerations

As part of the screening study, the agency may consider more than just emissions -- ambient air concentrations and health data may also be factored into the screening process. The screening study should afford the agency with enough perspective to determine the following:

o What pollutants should be covered in more detail?

o What source categories should be emphasized?

o What geographic areas should be covered? Is there is a need to focus on areas of high additive risk from multiple sources and pollutants?

o What is the relative importance of major and minor point sources and area sources?

o To what extent can the existing criteria pollutant inventory and permit files be used as a foundation for the air toxics inventory?

Ideally, the screening study should be performed quickly and inexpensively and yet yield results the agency has sufficient confidence in to make decisions concerning program direction. Screening can be an iterative process, with more focus placed on certain pollutants and sources as the agency's perception of its air toxics problem unfolds and as resources allow.

3.2 Overview of Screening Procedures

To minimize resources and time spent on the screening study, the agency should try to identify as many sources and to make as many emission estimates as possible using available data without making expensive and time consuming source contacts. A number of screening tools are available to help the agency identify potential emitters of air toxics and develop preliminary emission estimates. These tools are described as follows, with the applicability of each tool discussed below and in the appropriate appendices.

TABLE 3

FEATURES OF SCREENING AND DETAILED INVENTORIES

Screening Inventory

- Done first
- Preliminary emission estimates
- Minimal source contacts
- Maximum use of in-house resources
- Cover all potential sources

Miminal or
No
Source Contacts

|
V

Detailed Inventory

- Follows screening inventory
- Detailed emission estimates
- Extensive source contacts
- May be selective, per screening study results

|
V
Extensive
Source Contacts

(a) Source category-pollutant cross-indexes. These are tables associating source categories with pollutants, showing the potential for a given substance to be emitted by a particular facility. This qualitative identification process can be useful for two purposes:

(i) to determine which sources to send questionnaires to if the agency is focusing on specific pollutants; and

(ii) to direct the agency to the appropriate emission factors, apportioning factors, etc., if the agency is going to make screening estimates itself (as opposed to sending out questionnaires).

These cross-indexes could also be used by the agency to help evaluate applications for new permits or permit renewals.

One type of source category-pollutant cross-index is the SIC-pollutant file where SIC codes[12] are associated with specific air toxics. An excerpt from this cross-index is shown in Table 4, and the full cross-index file is presented in Appendix C. This file could be applied to the existing criteria pollutant inventory or permit file, both of which often contain SIC codes. This information allows the user to associate pollutants with SIC codes. Care should be taken in the use of this type of cross-index. Since SIC codes are fairly broad descriptors, many operations may be encompassed by some SICs.

Other source category-pollutant cross indexes have been developed, several of which are descriptive and not based on SIC or other codes. (See Appendices D, F and G. Some agencies may find the descriptive cross-indexes in Appendices F and G useful if they have more information about a source than just the SIC code.

(b) Emission factors. Just as criteria pollutant emission factors can be applied to activity levels or throughputs to estimate emissions, so too can air toxic emission factors be applied for this same purpose. The major source of air toxics emission factors is the EPA series entitled Locating And Estimating Air Emissions From Sources Of (Substance).[13] Reference 14 is another source of emission factors, focusing on fossil fuel combustion.

Another potential source of emission factor information is EPA's National Air Toxics Clearinghouse database.[15] States and local agencies have submitted permit and source test information to the Clearinghouse that may be of assistance in determining emission rates for many kinds of industrial facilities. Contact names and phone numbers are also given, allowing the user the opportunity to get more specifics directly from the supplying agency. As more data are supplied, the Clearinghouse should improve as a source of emissions data.

A list of emission factors for various substances and sources is included in Appendix H. The factors in this list should be used primarily as a default option if the agency is unable to determine the most applicable emission factor from the appropriate reference.

TABLE 4

EXCERPT FROM SIC/POLLUTANT CROSS INDEX[a]

SIC Code	SCC Code	Potential Pollutant	Reference (Appendix A)
2895	---	benzo(a)pyrene, POM, PAH, ammonia	5, 13
2899	---	hexachlorocyclopentadiene, xylene, copper, hydrazine, lead, cadmium, formaldehyde, arsenic, chromium, benzene, methyl methacrylate, maleic anhydride, ammonia, methyl chloride, perchloroethylene, toluene, vinyl chloride, trichloroethylene, methyl isocyanate, chlorine/HCl, hydrogen sulfide, styrene, radionuclides, zinc/zinc oxide	1, 4, 10, 13
2911	3 06 001 02 3 06 002 01 3 06 009 01 1 01 007 01 1 01 007 02 1 02 007 01 1 02 007 02 1 02 007 03 1 01 004 01 1 01 004 02 1 01 004 03 1 01 005 01 1 01 005 02 1 01 005 03	arsenic, beryllium, cresol, PAH, dimethyl sulfate, maleic anhydride, xylene, toluene, benzo(a)pyrene, phenol, mercury, lead, formaldehyde, cadmium, ethylene dichloride, POM, ethylene dibromide, nickel, chromium, benzene, coke oven emissions, ammonia, naphthalene, gasoline vapors, hydrogen sulfide, acetaldehyde, chlorine/HCl, zinc/zinc oxide	1, 3, 4, 5, 6, 8, 10, 11, 13
2918	---	hydrogen chloride	13
2921	---	toluene, benzo(a)pyrene, benzene, formaldehyde	1
2951	3 05 002 01	toluene, benzo(a)pyrene, mercury, POM, formaldehyde, PAH, chromium, benzene, asbestos, ammonia, methyl chloroform, methyl isocyanate	1, 4, 13
2952	3 05 001 01	formaldehyde, PAH, asbestos, POM, chromium, carbon tetrachloride	4, 6, 8, 13
2991	---	formaldehyde	13

---

[a] Complete index is included in Appendix C.

In general, emission factors are a useful screening technique since they can be applied to the level of activity specified in the existing criteria pollutant inventory or permit file to estimate emissions of air toxics. Emission factors are applicable for estimating emissions of sources for which factors are available and for which appropriate source information is available to apply them. An example emission factor application is shown in Appendix A.

(c) Apportioning (speciation) factors. These are factors that can be applied directly to Volatile Organic Compounds (VOC) or Particulate Matter (PM) totals in an existing criteria pollutant inventory or permit file to yield estimates of air toxics emissions. They are distinguished from emission factors in that they apply to VOC or PM emissions rather than activity levels or throughputs. Two major sources of VOC and PM apportioning factors, respectively, are EPA's VOC Species Data Manual[16] and Receptor Model Source Composition Library.[17] Examples of apportioning factors from these two sources are shown in Tables 5 and 6, respectively.

The factors from the VOC Species Data Manual have been updated in computer format for the National Acid Precipitation Assessment Program (NAPAP). The NAPAP VOC allocation factors are included in Tables I-1 and I-2 of Appendix I. These factors are formatted to yield VOC speciation factors as a function of Source Classification Code (SCC), which is the basic equipment code used in NEDS, EIS and many State and local inventories. Examples of the use of VOC and PM apportioning factors in developing preliminary emission estimates of air toxics are shown in Appendix A.

(d) Conservative material balances. For some combustion sources, solvent users and other evaporative loss sources, conservative assumptions can often be made concerning the fraction of a material input to or used by a process that is emitted. Commonly, all makeup solvent used by certain operations is assumed to be evaporated and a large fraction of metals in fuels is assumed to be exhausted. Hence, for many operations, screening estimates can be generated by making reasonable assumptions about the amount a toxic substance in a solvent, fuel, or process feed and then applying this to activity level information in the existing criteria pollutant inventory or permit file. Examples of the application of conservative material balances are given in Appendix A.

(e) Existing source data/emission estimates. The literature, permit and registration files, and the Air Toxics Clearinghouse contain source data and/or emission estimates (and in some cases, risk assessments) for many substances that may suffice for screening purposes. This is especially likely for many large production (e.g., SOCMI) facilities and facilities required to obtain a permit. For example, references 18 through 22 and 37 provide source locations, operating data and emission estimates for sources of ethylene dichloride, methylene chloride, carbon tetrachloride, trichloroethylene, chloroform, and perchloroethylene, respectively. The EPA Air Toxics Clearinghouse stores source and emissions data on thousands of facilities that have been submitted by States and local agencies, as well as risk estimates that have been computed by EPA for certain sources under the NESHAPS process. The Air Toxics Clearinghouse also publishes a bibliography[8] of references that may be useful in locating data and emission estimates. This bibliography is scheduled to be updated in July, 1986.

TABLE 5

EXAMPLE EXCERPT FROM VOC SPECIES DATA MANUAL[16]

DECEMBER 14, 1978 TABLE 4-02-006A

POINT SOURCE EVAPORATION, SURFACE COATING
PRIMER, GENERAL
DATA CONFIDENCE LEVEL: IV

CONTROL DEVICE: NONE
PROCESS MODIFICATION: NONE
KVB PROFILE KEY 0134

LINE NO.	SAROAD CODE	CHEMICAL NAME	MOLECULAR WEIGHT	PERCENT WEIGHT	PERCENT VOLUME
1	43118	MINERAL SPIRITS	114.00	41.00	31.28
2	45101	NAPHTHA	114.00	1.00	.78
3	45102	ISOMERS OF XYLENE	106.16	4.90	4.00
4	45202	TOLUENE	92.13	3.90	3.65
5	43551	ACETONE	58.08	7.10	10.60
6	43552	METHYL ETHYL KETONE	72.10	7.70	9.30
7	43560	METHYL ISOBUTYL KETONE	100.16	3.10	2.69
8	43301	METHYL ALCOHOL	32.04	1.00	2.69
9	43302	ETHYL ALCOHOL	46.07	.80	1.48
10	43304	ISOPROPYL ALCOHOL	60.09	2.80	4.08
11	43305	N-BUTYL ALCOHOL	74.12	4.00	4.69
12	43367	GLYCOL ETHER	62.07	11.50	16.07
13	43433	ETHYL ACETATE	88.10	.90	.87
14	43435	N-BUTYL ACETATE	116.16	9.50	7.12
15	43444	ISOPROPYL ACETATE	104.00	.80	.70
		TOTAL		100.00	100.00

TABLE 6

EXAMPLE EXCERPT FROM RECEPTOR MODEL SOURCE COMPOSITION LIBRARY[17]

```
13-Jun-85                                   SOURCE LIBRARY


            SOURCE:    HEAVY DUTY DIESEL                                          PROFILE:      32202
            SCC:       NONE                                                       RANKING:       3338
            CONTROLS:  NONE                                                       RATING :          A
......................................................................................................
                                   FINE                             COARSE                         TSP
 SPECIES    SPECIES  *********  <2.5 UM  ******    *********  2.5-10UM ******    *********  <30 UM  ******
 NUMBER      NAME    % BY WT     + -     UNC       % BY WT      +-     UNC       % BY WT     +-     UNC
 -------     -----   ---------  -------  -----     ---------  -------- -----     ---------  -----  ------
       4      BE       NA        + -      NR         NA        + -      NR         NA        + -      NR
       5      B       0.130      + -     0.020      0.130      + -     0.020      0.130      + -     0.020
       9      F         <        + -      NR          <        + -      NR          <        + -      NR
      11      NA      0.800      + -     0.100      0.800      + -     0.100      0.800      + -     0.100
      12      MG      0.900      + -     0.150      0.900      + -     0.150      0.900      + -     0.150
      13      AL      1.000      + -     0.200      1.000      + -     0.200      1.000      + -     0.200
      14      SI      1.600      + -     0.200      1.600      + -     0.200      1.600      + -     0.200
      15      P       0.150      + -     0.020      0.150      + -     0.020      0.150      + -     0.020
      16      S       2.700      + -      NR        2.700      + -      NR        2.700    . + -      NR
      17      CL        <        + -      NR          <        + -      NR          <        + -      NR
      19      K       0.170      + -     0.030      0.170      + -     0.030      0.170      + -     0.030
      20      CA      0.700      + -     0.200      0.700      + -     0.200      0.700      + -     0.200
      21      SC        <        + -      NR          <        + -      NR          <        + -      NR
      22      TI      0.014      + -     0.004      0.014      + -     0.004      0.014      + -     0.004
      23      V         <        + -      NR          <        + -      NR          <        + -      NR
      24      CR      0.002      + -     0.001      0.002      + -     0.001      0.002      + -     0.001
      25      MN      0.039      + -     0.004      0.039      + -     0.004      0.039      + -     0.004
      26      FE      0.600      + -     0.100      0.600      + -     0.100      0.600      + -     0.100
      27      CO        <        + -      NR          <        + -      NR          <        + -      NR
      28      NI      0.003      + -     0.001      0.003      + -     0.001      0.003      + -     0.001
      29      CU      0.025      + -     0.010      0.025      + -     0.010      0.025      + -     0.010
      30      ZN      0.160      + -     0.010      0.160      + -     0.010      0.160      + -     0.010
      31      GA        <        + -      NR          <        + -      NR          <        + -      NR
      32      GE        <        + -      NR          <        + -      NR          <        + -      NR
      33      AS        <        + -      NR          <        + -      NR          <        + -      NR
      34      SE        <        + -      NR          <        + -      NR          <        + -      NR
      35      BR      <0.05      + -      NR        <0.05      + -      NR        <0.05      + -      NR
      37      RB        <        + -      NR          <        + -      NR          <        + -      NR
      38      SR      0.014      + -     0.003      0.014      + -     0.003      0.014      + -     0.003
      40      ZR      0.004      + -     0.001      0.004      + -     0.001      0.004      + -     0.001
      47      AG        <        + -      NR          <        + -      NR          <        + -      NR
      48      CD        <        + -      NR          <        + -      NR          <        + -      NR
      50      SN        <        + -      NR          <        + -      NR          <        + -      NR
      51      SB        <        + -      NR          <        + -      NR          <        + -      NR
      55      CS        <        + -      NR          <        + -      NR          <        + -      NR
      56      BA      0.077      + -     0.003      0.077      + -     0.003      0.077      + -     0.003
      58      CE        <        + -      NR          <        + -      NR          <        + -      NR
      80      HG        <        + -      NR          <        + -      NR          <        + -      NR
      82      PB      1.300      + -     0.300      1.300      + -     0.300      1.300      + -     0.300
     201      OC     20.900      + -      NR       20.900      + -     0.140     20.900      + -     0.140
     202      EC     54.800      + -      NR       54.800      + -      NR       54.800      + -      NR
     203      SO4     4.900      + -     0.900      4.900      + -     0.900      4.900      + -     0.900
     204      NO3      NA        + -      NR         NA        + -      NR         NA        + -      NR
 SUM( % )            88.288                        88.288                        88.288

 NOTES:     OC = ORGANIC CARBON :  EC = ELEMENTAL CARBON :  NA = NOT ANALYZED :  NR = NOT REPORTED
            < = LESS THAN DETECTION LIMIT
            OTHER NOTES :      ENTIRELY DIESEL TRUCKS (30 TON).  TUSCARORA, PA. TUNNEL 1977.  HYDROGEN 5+-1%,
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What these screening tools have in common is that they allow the agency to identify potential emitters and make screening estimates without making time consuming and expensive source contacts. Once the screening study is complete, the detailed air toxics inventory can commence, if necessary. In some cases, the screening study may divulge that a detailed inventory may not be necessary, at least for some pollutants or in some areas. Or it may turn out that selective coverage, either for specific sources, pollutants or for small areas, may be sufficient for program planning and control purposes. This is the point of the screening process -- to help the agency avoid expending resources on activities that do not yield significant reductions in air toxic emissions and risks. This allows the bulk of available agency resources to be devoted to more detailed data collection and analysis and to focus on those pollutants, sources, and geographic areas that pose most risk to the community.

Table 7 shows an example of possible results from an inventory screening study where the emissions data have been modeled to estimate aggregate cancer incidence. These data show the relative risk associated with various point and area sources in a given area. This kind of screening exercise would provide some basis for the agency to focus any subsequent data collection and control effort. Of course, any screening estimates of emissions and risk would probably be considered preliminary, to be followed by more detailed estimates for the more important sources and pollutants.

3.3 Screening Study Error

Because crude techniques may be used in screening studies, errors are unavoidable. Hence, it is generally advisable to be conservative in such studies, i.e., to develop estimates that do not underestimate emissions and associated risks. Since the point of the screening study is to identify areas where additional attention is needed, it is better to overestimate emissions than to underestimate emissions. Presumably, overestimates of emissions will be put into proper perspective later on in the inventory process, but underestimates could conceivably lead to false conclusions that may not be corrected. One way to deal with potential errors is to view the screening process as an iterative one. That is, instead of assuming that the focus for the entire program can be correctly ascertained from a single screening, the agency might opt to keep the process open for a second iteration to fine tune the results.

3.4 Review of Screening Study Results

It may prove helpful at the end of the screening study (or later, after the detailed inventory) to make the results available for outside review, at least in summary form. This review could involve having various noninventory personnel review the results to see if the data patterns and conclusions appear reasonable. Reviewers should include persons that are sufficiently detached from the inventory process so they will not be reluctant to point out possible errors and shortcomings. Equally important, these reviewers should include potential users of the air toxics inventory data such as modelers and planners

TABLE 7

PERCENT OF CANCER RISK ASSOCIATED WITH POINT AND AREA SOURCES[a]

Point Sources	% of Total Incidence[b]
Chemical production/usage	10
Metal manufacturing	8
Petroleum refining	5
Rubber production	5
Utilities	3
Publicly Owned Treatment Works (POTWs)	2
All others	16
TOTAL POINT SOURCE	49
Area Sources	
Road vehicles	22
Solvent usage	10
Gasoline marketing	9
Waste oil burning	8
Woodsmoke (stoves/fireplaces)	0.5
All other	1.5
TOTAL AREA SOURCE	51

[a] In 35 counties, from Reference 23.

[b] Because of the uncertainties in the incidence calculations used to derive these estimates, the numbers should be regarded as rough indicators only. They will not necessarily apply to any given geographical area.

who will need the data to assist in control strategy development. And, at some point, comments from outside interests may be desirable, including industry, health specialists and environmental groups. Often, bringing differing and diverse viewpoints into a process can be quite helpful in spotting anomalies, misrepresentations, or shortcomings that may not be detected by those directly involved in inventory effort. This review process will heighten the visibility and credibility of the air toxics inventory, assisting any subsequent data collection efforts and improving the likelihood of acceptance of any control program based on these data.

3.5 Use of Screening Tools in Evaluating Permit Applications

The emission inventory screening tools presented in this report may be useful to agency permitting staff in evaluating permit applications (either permit renewals or permits for new or modified sources) for air toxics. The typical permit review period (e.g., 90 days) does not allow for detailed research; therefore, these tools can be of great importance. Whereas the screening tools may not always provide the level of detail or accuracy necessary for complete evaluation of permit applications with respect to air toxic emissions, they can provide information useful in determining which applicants need to provide more detailed information. The results of the permit process can feed into the air toxics emission inventory, thus providing an improving foundation of information useful in future permit reviews and in developing other aspects of regulatory programs.

The first step in reviewing permit applications is to determine if all toxic pollutants of concern potentially emitted by the proposed source are accounted for and if the stated emission levels are reasonably accurate. Such information may be needed initially to determine the applicability of the permitting requirements. Air toxics emissions screening tools may be useful in determining whether the source potentially emits specific pollutants subject to regulation under the Act or other toxic compounds of concern to State or local permitting agencies. For example, the permitting staff could use the source category/pollutant indices, emission factors or apportioning factors in the appendices to determine if all pollutants of concern have been included in the permit application.

In some cases, permit applications will contain only generic information about the types or classes of pollutants emitted from a source. In these instances, the agency may wish to use speciation/apportioning profiles (Appendix I) to identify more precisely which toxic pollutants may be emitted and, in turn, require the applicant to be more specific.

Air toxics emission inventory data or techniques can also be helpful in reviewing the level of emissions contained in a permit application. Emission estimates provided by the applicant could be cross-referenced against estimates from comparable sources available through the inventory, or the emission factor summary (Appendix H) could be used to check emission levels. Of course, the applicant should be as accurate as possible in making emission calculations of toxic pollutants since emission estimates in a permit application become emission limits under the permit conditions which must be met during operation. Where emission estimates are relatively uncertain (e.g., for new processes), agencies with operative programs sometimes require emissions tests or other means of verification.

Examples of the uses of the inventory screening tools mentioned here appear in Appendix A.

CHAPTER 4

POLLUTANT COVERAGE

The major difference between air toxics inventories and criteria pollutant inventories is in substance coverage. Since there are literally thousands of potentially toxic substances as compared to only a handful of criteria pollutants, the compilation effort can become formidible since data collection and data handling resource needs increase quickly as more and more substances are inventoried. In this regard, limiting the number of substances included in the detailed inventory to those causing most of the problem may be one of the most valuable outcomes of the screening study.

4.1 "Open-ended" Vs. "Directed" Approaches

There are two fundamentally different approaches that can be taken when soliciting air toxics emissions data: the "open-ended" and "directed" approaches. In the open-ended approach, the agency asks each source to submit data on whatever air toxics it emits, either without specifying any compounds of interest or by specifying a very broad list containing perhaps hundreds of compounds. The open-ended approach is commonly used in permit-based inventories where point source applicants are asked to submit information on whatever compounds they expect to emit. By contrast, in the directed approach, the agency may target a fairly limited number of compounds it wants to focus on.

A potential advantage to the open-ended approach is that a single "one shot" data collection effort can be employed to get information on most, if not all, toxics being emitted in an area. In theory, this approach may provide a better overall perspective of an area's air toxics problem than will the directed approach because the agency need not have predetermined what substances are most important.

The disadvantages to the open-ended approach are several:

- Without some focus on a limited number of compounds, questionnaire respondants may overlook and not report the use and/or emissions of many air toxics. This may particularly be the case if such compounds are present at low levels or as contaminants in a facility's product, feedstock materials, etc., or if trade name solvents are used and the respondant does not know what comprises them. In this latter regard, many chemical synonyms and trade names may be reported that the agency cannot readily interpret. For example, a source may report it uses Dutch liquid in its process, which is an alternative name for ethylene dichloride (EDC). Or, hypothetically, a source may report that it uses a material named "Super Solvent No. 209" which may contain a large number of substances, including toluene, xylenes, etc. Unless the State or local agency can associate these synonyms and tradenames with specific compounds of interest in its air toxics inventory, it may find itself unable to utilize much of the data submitted by various respondants. (Chemical name synonyms for commonly inventoried substances are presented in Appendix L. The use of Material Safety Data Sheets and other techniques for determining compositions of trade name products is discussed in Chapter 8.)

- The inventory agency may receive much more information than it needs or is prepared to deal with, especially for compounds not emitted at problem levels.

- Unless sufficient quality checks and followup contacts can be made, the response rates may be low and the data suspect.

- Industry may resist reporting on hundreds of substances without regard for the level at which each substance is emitted. One way to counter this objection is to develop a set of conditions that allow certain source/emission level/pollutant combinations to be exempted from detailed reporting. For example, an agency could exclude from reporting any emissions resulting solely from the combustion of unadulterated fuels. Or it might exclude from reporting any emissions of certain compounds discharged below certain rates. Substance toxicity may also be factored into the agency's exemption criteria. (This is discussed more in Chapter 6.)

In the directed approach, an agency may focus on a specific set of compounds it is interested in based on recommendations from a health group or possibly as a result of an emissions screening study. Advantages of the directed approach are:

- It generally allows the agency to focus its data collection effort on fewer sources, targeting those which it believes are probable emitters of the particular substances on its list.

- The amount of data obtained may be much more manageable.

Disadvantages are:

- Additional contacts to the same sources may become necessary if the initial list of pollutants is expanded by the agency. (This may be acceptable if the additional compounds are phased in over the course of the normal update cycle.)

- The agency must either have some predetermined idea of what compounds are important at the outset of the inventory effort or else it must arbitrarily use a designated list. Unless the agency has performed a preliminary screening survey of some sort to determine the major compounds of potential concern, it runs the risk of wasting resources on relatively unimportant compounds while possibly neglecting some compounds actually posing considerable hazard.

4.2 State and Local Agency Lists

Recent surveys of existing air toxics programs indicate that many agencies use a specific list of substances whereas others accept open-ended submissions and a few have hybrid programs -- apparently targetting a specific list of substances but accepting data submitted on any substance.

Several common rationale for selecting a group of compounds are listed below. All of these rationale are not mutually exclusive and more than one rationale may be the basis for selection in some agencies.

- Substance toxicity (most common rationale)
- Emissions potential
- Substance toxicity and emissions potential
- Use an EPA list

  e.g. - NESHAPS and NESHAPS candidate substances
  - Acute Hazard List

- Adopt list used by another State or local agency
- List mandated to agency (e.g., by a legislature)

The actual compounds selected for inclusion in agency programs vary considerably, and space precludes presenting or summarizing all of the lists or compounds. However, a number of compounds are commonly included in many agency lists. Table 8 shows 64 compounds that are common to at least 4 agency's lists. Reference 24 presents methods for pollutant selection and prioritization used by various agencies.

4.3 Core List of Compounds for Possible Consideration

EPA is not recommending a specific list of compounds for inclusion in a given area's air toxics inventory. Unlike criteria pollutants, many air toxics are not emitted in every locale. Some air toxics, of course, will be fairly widespread, such as those associated with general solvent use and area sources (e.g., benzene, toluene, xylenes, formaldehyde, perchloroethylene, methyl chloroform, methylene chloride and trichloroethylene). These substances would be emitted in most urban areas. However, many compounds that are primarily associated with point sources (e.g., epichlorohydrin, acrylonitrile, phosgene, etc.), might only be emitted by a few large producers or users in the entire U. S. and may not be emitted in significant levels at all in most areas.

As starting point, in the absence of locale-specific screening results, an agency may consider inventorying the compounds in Table 9 for which EPA has set NESHAPS under Section 112 of the Clean Air Act, or has listed or intends to list in the near future, and/or that were identified as important contributors to aggregate cancer incidence in EPA's "Six-Month Study."[11] Most of these compounds will be emitted in industrialized urban areas and, because these compounds are important from a national risk standpoint, a considerable amount of work has been done or is underway to analyze and characterize them. Hence, these compounds will generally have better data bases associated with them than are available for many other noncriteria substances. The availability of this data will greatly assist in inventory preparation.

There are compounds which will be locally important in some areas which will not pose significant national risk. Acrylonitrile, 4,4-methylene dianiline and propylene oxide are examples of substances which may account for

TABLE 8 SUBSTANCES CONSIDERED BY FOUR OR MORE AGENCIES[25]

Acetaldehyde
Acrolein
Acrylonitrile
Allyl chloride
Arsenic
Asbestos
Benzene
Benzidine
Benzo(a)pyrene
Benzyl chloride
Beryllium
Biz(chloromethyl)ether
1,3-Butadiene
Cadmium
Carbon Tetrachloride
Chlordane
Chlorobenzene
Chloroform
Chloroprene
Chromium
Cresol
1,4-Dichlorobenzene
3,3-Dichlorobenzidine
Dimethyl sulfate
1,4-Dioxane
Dioxins
Epichlorohydrin
Ethylene dibromide
Ethylene dichloride
Ethylene oxide
Formaldehyde
Heptachlor
Hexachlorocyclopentadiene
Hydrazine
Hydrogen sulfide
Lead
Lindane
Maleic anhydride
Manganese
Mercury
Methyl bromide
Methyl chloride
Methyl chloroform
Methylene chloride

Continued.

TABLE 8 Continued

beta-Naphthylamine
Nickel
Nitrobenzene
N-nitrosodimethylamine
Nitrosomorpholine
Parathion
Perchloroethylene
Phenol and chlorinated phenols
Phosgene
Polychlorinated biphenyls (PCB)
Polycyclic aromatic hydrocarbons (PAH)[a]
Propylene oxide
Radionuclides
Styrene
Tetrahydrofuran
Toluene
Trichloroethylene
Vinyl chloride
Vinylidene chloride
Xylene

---

[a] Also defined as "PIC" (or products of incomplete combustion) in EPA's "Six-Month Study."[11] B(a)P is used as a surrogate for calculating risk and aggregate cancer incidence from PIC exposure in this study.

TABLE 9

CORE LIST OF COMPOUNDS FOR CONSIDERATION IN AN AIR TOXICS EMISSION INVENTORY[a]

Arsenic

Asbestos

Benzene

Beryllium

1,3 Butadiene

Cadmium

Carbon Tetrachloride

Chloroform

Chromium

Coke Oven Emissions

Ethylene Dibromide

Ethylene Dichloride

Ethylene Oxide

Formaldehyde

Gasoline Vapors

Mercury

Methylene Chloride

Perchloroethylene

Polyclyclic Organic Matter[b]

Radionuclides

Trichloroethylene

Vinyl Chloride

Vinylidene Chloride

---

[a] As mentioned in the text, these compounds were selected because EPA has (1) set NESHAPS for them under Section 112 of the Clean Air Act, or has listed or intends to list them, or (2) identified them as important contributors to aggregate cancer risk in its Six-Month Study.[11] State and local agencies should not infer that other compounds should be excluded from consideration if they are not on this list.

[b] Also defined as "PIC," or products of incomplete combustion, in EPA's "Six-Month Study."[11] B(a)P is used as a surrogate for calculating risk and aggregate cancer incidence from PIC exposure in this study.

significant exposures in the proximity of a few larger chemical manufacturing plants, but which do not account for significant aggregate cancer incidence in the U. S.[11] Hence, the agency should not automatically exclude compounds from consideration because they are not on the above (or any or other) list. And since EPA continues to evaluate and list compounds for NESHAPS under Section 112 of the Clean Air Act, the agency may wish to include any newly listed compounds in its inventory, as well.

CHAPTER 5

SOURCE CATEGORY COVERAGE

For the most part, an agency must deal with the same types of sources and source categories in both criteria and air toxics inventories. The fundamental reason for this inherent similarity is that most air toxics are a subset of either particulate matter (PM) or volatile organic compounds (VOC); most toxic metals and heavy organics are emitted in the PM fraction while most toxic light organics are associated with the VOC fraction. For this reason, a complete criteria pollutant inventory will serve as a good starting point for the air toxics inventory.

Although most sources of air toxics should already be included in complete criteria pollutant inventories, every source will not emit toxic compounds. Table 10 presents a simplified source characterization scheme that may prove helpful in providing a broad perspective of what kinds of sources emit what air toxics. Table 10 summarizies available nationwide emission totals for the substances evaluated in EPA's "Six-Month Study."[11] The sources in Table 10 are lumped by similarity of operations, physical characteristics, mode of release, etc., into the following generic categories that account for a large fraction of air toxic emissions.

1. SOCMI (synthetic organic chemical manufacturing industry)
2. Solvent evaporation (surface coating, degreasing, printing, etc.)
3. Stationary fuel combustion (boilers, internal combustion engines)
4. Metal processing (mining, refining, production of metals)
5. Mobile sources (automobiles, boats, planes, etc.)
6. Waste oil combustion
7. Other (incineration, in process fuel use, etc.)

Several characterizations can be made from Table 10 that may prove useful in understanding which compounds are generally associated with what sources:

-Roughly half of the 86 substances are largely emitted from SOCMI facilities, i.e., producers of synthetic organic chemicals; users of these chemicals as feedstocks; or facilities that produce these chemicals indirectly as contaminants or byproducts. Major emitting points within SOCMI include equipment leaks (from pumps, valves, compressors, etc.), storage and handling losses (loading, unloading and breathing losses from railroad cars, storage tanks, etc.) process vents (distillation towers and reactor processes), and secondary and indirect sources (e.g., (wastewater treatment).

-Solvent use accounts for the major release of a number of substances including cyclohexane, methyl ethyl ketone, chlorobenzene, nitrobenzene, perchloroethylene, trichloroethylene, methyl chloroform, cresols, acrolein, methylene chloride, and xylenes. Solvent loss occurs from evaporation during surface coating, degreasing, dry cleaning, printing, etc. Minor point and area sources are significant contributors.

TABLE 10

NATIONWIDE AIR TOXIC EMISSIONS BY BROAD SOURCE CATEGORY[26]

SUBSTANCE	PERCENT OF EMISSIONS BY EACH SOURCE CATEGORY								TOTAL EMISSIONS[a] (KKG/YR)	CONFIDENCE[b]
	SOCMI	SOLVENT USE	STATIONARY FUEL COMBUSTION	METAL PROCESSING	MOBILE	WASTE OIL COMBUSTION	OTHER	SOURCE OF OTHER		
Acetaldehyde	22.0	36.0	42.0		TR				1,782	C
Acetic acid	35.8		64.2						72,046	C
Acetonitrile	100.0								591	C
Acrolein	41.8	58.2							41.5	C
Acrylamide	97.4		2.6						3.8	B
Acrylonitrile	100.0								2,664	B
Allyl chloride	100.0								408	B
Ammonia	99.9		0.1		TR				110,109	C
Barium carbonate	100.0								160	C
Benzene	6.0				70.2	TR	23.8	coke ovens, gas marketing	118,145	A
Benzyl chloride	99.0								38	A
Beryllium			83.7	3.8	1.4	0.8	10.4	coke ovens	163	C
1,3-Butadiene	99.8						0.2	fungicide	4,737	C
Cadmium	10.0		23.7	65.6		0.6			475	B
Carbon disulfide	99.9								55,549	C
Carbonyl sulfide	100.0								23,423	C
Carbon tetrachloride	15.6	4.2					80.2	fumigant, lab use, storage and marketing	27,482	C
Chlorine	1.5		98.2				0.2	glass manufacturing, wood processing, brick kilns	615,972	C
Chloroacetic acid	100.0								24.9	C
Chlorobenzene	.8	99.2							79,720	C

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[a] Note that emissions do not represent a particular year. Note also that these data are based on fragmented and sometimes old, inconsistent data, since reliable air toxics emission estimates are only slowly forthcoming. The proportions in this table will not necessarily apply to any particular region or urban area -- especially for point sources.

[b] A qualitative ranking where "A" represents best agreement among sources and "C" represents poor agreement or perhaps only one source for the estimate.

TABLE 10 (CTD.)

NATIONWIDE AIR TOXIC EMISSIONS BY BROAD SOURCE CATEGORY (Continued)

SUBSTANCE	PERCENT OF EMISSIONS BY EACH SOURCE CATEGORY								TOTAL EMISSIONS (KKG/YR)	CONFIDENCE SCORE
	SOCMI	SOLVENT USE	STATIONARY FUEL COMBUSTION	METAL PROCESSING	MOBILE	WASTE OIL COMBUSTION	OTHER	SOURCE OF OTHER		
Chloroethane	100.0								4,541	C
Chloroform	11.4	47.5					41.1	chlorination, wastewater	6,940	C
Chloroprene	100.0								838	C
Chromium			89.6	0.2		1.4	8.9	cement production, coke ovens	2,819	C
Coke oven emissions	100.0								NA	C
Copper			24.2	75.8					10,425	C
o-Cresol	20.9	60.8		9.1			9.2	disinfectant, cleaning compound	2,047	B
m-Cresol	11.1	68.3		10.2			10.3	disinfectant, cleaning compound	4,980	B
p-Cresol	9.9	69.3		10.4			10.4	disinfectant, cleaning compound	4,146	B
Cumene	100.0								879	C
Cyclohexane		100.0							428	C
Dibenzofuran							100.0	combustion and pyrolysis of chlorinated compounds	NA	C
1,2-Dibromoethane	100.0				TR				885	C
p-Dichlorobenzene	0.8						99.2	space deodorant, moth control	22,682	B
1,2-Dichloroethylene	100.0								46.9	C
Dimethyl nitrosamine	93.4						6.6		98	B
Dioctylphthalate	100.0								NA	C
Epichlorohydrin	100.0								217	B
Ethyl benzene	48.1					51.9			1.04	C
Ethylene	98.6		1.1		TR		0.3	artificial ripening of fruits and vegetables	209,524	C

TABLE 10 (CTD.)

NATIONWIDE AIR TOXIC EMISSIONS BY BROAD SOURCE CATEGORY (Continued)

SUBSTANCE	PERCENT OF EMISSIONS BY EACH SOURCE CATEGORY								TOTAL EMISSIONS (KKG/YR)	CONFIDENCE SCORE
	SOCMI	SOLVENT USE	STATIONARY FUEL COMBUSTION	METAL PROCESSING	MOBILE	WASTE OIL COMBUSTION	OTHER	SOURCE OF OTHER		
Ethylene dichloride	90.0	5.0			2.0		2.0	fumigant, pesticide, color film	64,800	C
Ethylene glycol	100.0								982	C
Ethylene glycol monoethyl ether	100.0								14.0	C
Ethylene oxide	31.3						68.7	fumigant, sterilant	5,680	B
Ethyl ester acrylic acid	100.0								203	C
Formaldehyde	49.9		17.5		32.6				570,000	C
Hexachlorocyclopentadiene	100.0								NA	B
Hexahydro-2h-azepin-1-one	100.0								4,221	C
Isopropyl alcohol	100.0								1,310	C
4,4-Isopropylidenediphenol	100.0								NA	C
Maleic anhydride	100.0								1,504	C
Manganese	1.8		15.8	76.2	TR		6.2	battery production, coke ovens	16,356	C
Melamine	100.0								NA	C
Methanol	98.6	1.4							23,582	C
Methyl chloroform	0.1	78.6					21.3	adhesives, aerosols, paint	212,774	A
Methyl chloride	100.0								23,982	B
Methylene chloride		56.1			TR		43.6	aerosol, foam blowing	200,409	C
Methyl ethyl ketone		100.0							5,317	C
4,4-Methylenedianiline	100.0								26.1	C
Methyl methacrylate	100.0								728	C

TABLE 10 (CTD.)

NATIONWIDE AIR TOXIC EMISSIONS BY BROAD SOURCE CATEGORY (Continued)

SUBSTANCE	PERCENT OF EMISSIONS BY EACH SOURCE CATEGORY								TOTAL EMISSIONS (KKG/YR)	CONFIDENCE SCORE
	SOCMI	SOLVENT USE	STATIONARY FUEL COMBUSTION	METAL PROCESSING	MOBILE	WASTE OIL COMBUSTION	OTHER	SOURCE OF OTHER		
Napthalene	100.0								119.4	B
Nickel			84.1	7.3	8.0	0.1	0.1	coke ovens	10,182	B
Nitrobenzene	4.0	96.0							3,032	B
Nitrosomorpholine	0.2						99.8	corrosion inhibitor, polishes, optical brightener	4,558	B
Pentachlorophenol	11.9						88.1	fungicide, home and garden applications, preservative	101	B
Perchloroethylene	6.4	93.6				TR			144,083	A
Phenol	100.0				TR				2,406	C
Phosgene	100.0								91	B
Phthalic anhydride	100.0								1,059	C
Polychlorinated biphenyls							100.0	transformers, waste incineration	NA	C
Polycyclic organic matter			51.8		42.6		5.6	waste incineration, charcoal production, coke ovens	NA	C
Propene	100.0				TR				37,540	C
Propylene oxide	100.0								608	C
Styrene	100.0								5,625	C
Terephthalic acid	100.0								NA	C
Titanium dioxide							100.0	pigment use	4,278	C
1,2-Toluene diisocyanate	100.0								51.0	C
Toluene	37.1	0.1			61.6		1.0	coke ovens	1,013,379	C
Trichloroethylene	0.1	91.4				TR	8.5	adhesives, paint	85,917	A
Vinyl acetate	100.0								682	C

TABLE 10 (CTD.)

NATIONWIDE AIR TOXIC EMISSIONS BY BROAD SOURCE CATEGORY (Continued)

SUBSTANCE	PERCENT OF EMISSIONS BY EACH SOURCE CATEGORY								TOTAL EMISSIONS (KKG/YR)	CONFIDENCE SCORE
	SOCMI	SOLVENT USE	STATIONARY FUEL COMBUSTION	METAL PROCESSING	MOBILE	WASTE OIL COMBUSTION	OTHER	SOURCE OF OTHER		
Vinylidene chloride	100.0								67.0	C
o-Xylene	1.8	52.3			45.9				122,044	B
m-Xylene	0.8	54.0			45.2				206,152	B
p-Xylene	3.8	48.5			47.7				108,759	B
Zinc			3.7	96.3					55,572	C
Zinc oxide				1.7			98.3	pigment use	7,208	C

-Metal processing includes emissions from mining, refining and the production of alloy and metal products. Emissions of zinc, manganese, copper, cadmium, nickel and beryllium are all significant. Although not explicitly identified with this category, chrome plating is a very important source of chromium emissions.

-Mobile sources are major emitters of benzene, toluene, isomers of xylene, POM and formaldehyde. Large percentages of all benzene, toluene, POM, and xylene emanate from mobile sources, primarily from tailpipe emissions and evaporation from gasoline powered vehicles.

-Stationary fuel combustion is the largest emitter of POM and several metals (beryllium, chromium and nickel) and an important source of chlorine, cadmium, copper, formaldehyde and manganese. Generally, smaller sources such as woodstoves will be the most important emitters of POM.

-Except for waste oil combustion, so-called "nontraditional sources" are not covered in Table 10. Nontraditional sources are those that have not traditionally been included in criteria pollutant inventories, but which may be significant emitters of air toxics. Potentially important nontraditional sources are listed below:

- o Publicly-owned Treatment Works (POTWs), i.e., municipal sewage treatment plants.

- o Treatment, Storage and Disposal Facilities (TSDFs) which handle hazardous waste in the following kinds of operations:

    - landfills and land treatment
    - surface impoundments and treatment tanks
    - waste piles
    - drum handling
    - unloading and storage
    - recycling
    - deep well injection
    - incineration

- o Waste oil combustion.

- o Wood combustion (stoves, fireplaces).

- o Drinking water aeration.

- o Cooling towers.

- o Hospital and medical supply sterilizers.

-Methylene chloride and methyl chloroform (1,1,1-trichloroethane) are emitted in important quantities from solvent use, aerosols, etc., but may not be accounted for in VOC inventories that have been adjusted to remove non-photochemically reactive compounds.

It must be emphasized that Table 10 is based on fragmented and sometimes old, inconsistent data, since reliable air toxics emission estimates are only slowly forthcoming. Hence, the conclusions drawn therefrom should not be considered absolute. Moreover, since the underlying data in Table 10 are representative of the entire nation, the proportions will not necessarily apply to any particular region or urban area -- especially for point sources. Nevertheless, the broad perspective offered by this summary may offer some help in the screening process in understanding and characterizing the general distribution of air toxics emissions.

CHAPTER 6

POINT/AREA SOURCE DISTINCTIONS

Most emission inventories distinguish between point sources and area sources. Point sources are those sources large enough to permit and/or to keep individual records on. Area sources are sources too small and/or numerous to permit or to warrant individual recordkeeping. (Some inventories also distinguish between major point and minor point sources.) The rationale for making this distinction is to minimize the reporting burden on smaller sources and to reduce the volume of point source inventory records.

6.1 Making the Point/Area Source Distinction

The point/area source distinction can be made in several ways:

(a) By defining all sources within particular source categories as either point or area sources. For example, all gasoline service stations, dry cleaners, etc., might be handled as area sources and exempted from reporting, and, conversely, all hospital sterilizers and chrome platers may be required to submit emissions data as point sources.

(b) By establishing emission cutoff or "de minimis" levels. For example, sources might only be required to report emissions greater than "x" tons per year.

Various de minimis levels and exemption criteria are presently being employed by States and local agencies in their air toxics inventories. Some of these are listed in Table 11 as examples. At least one agency has defined cutoff levels for each toxic substance covered in its inventory.

6.2 Factors Affecting the Point/Area Source Distinction

The agency needs to make several decisions regarding the point/area source distinction. For example, the point/area source distinctions for criteria pollutants need to be evaluated carefully if the agency plans to base the air toxics inventory on the criteria pollutant inventory. Small industrial sources such as dry cleaners, degreasers, chrome platers, paint coaters, waste oil boilers, etc., are often considered collectively as area sources in criteria pollutant inventories since their emissions of PM or VOC may not exceed typical cutoff levels of 5-100 tons per year. In some cases, these smaller sources may even be excluded altogether from the existing inventory and not even covered as area sources. If the agency decides that it needs to permit and keep individual records on certain of these smaller sources to afford a proper evaluation of emissions and risk, additional contacts may be necessary to obtain the necessary source and/or emissions data. Conceivably, the agency might even go to a "zero" emission cutoff

TABLE 11

EXAMPLE CUTOFF LEVELS AND EXEMPTED SOURCES

Example Cutoff levels

- None
- 1 TPY of any toxic substance
- 100 TPY of any regulated pollutant
- 0.25 lb emission of any toxic substance per 8 hr time period
- Cutoff level for each inventoried compound (as function of TLV)

Examples of Exempted Sources

- Boilers <100 MMBtu/hr exempted
- Boilers firing wood or unadulterated fossil fuels
- Certain small sources exempted (e.g., dry cleaners, service stations)

level for a few important sources, thereby designating all sources within particular categories (e.g., all chrome platers or all benzene storage tanks) as point sources regardless of size, throughput or emissions.

The principal advantage of considering sources individually rather than collectively is that it results in more accurate estimates of emissions, ambient air concentrations and risks. It also improves the accuracy of any detailed control strategy projections. A negative aspect of considering many small sources as point sources is that more resources are required both by the agency and the industrial community to collect and digest the greater volume of point source data. In this regard, industry may strongly resist any requirements to acquire information on very small sources without some reporting exemptions based on emission rates and/or substance toxicities. Of course, if an agency is focusing on all sources within relatively small geographic areas, the added expense of considering small sources individually may be necessary.

One potential problem should be mentioned with using cutoff or de minimis levels in air toxics inventories, a problem that exists in criteria pollutant inventories, as well. If the cutoff level chosen allows a significant number of sources to escape consideration as point sources, these sources will have to be considered collectively as area sources if the agency is seeking a comprehensive emission inventory. For example, if the agency exempts coin-operated (self-service) dry cleaners and small, cold-cleaner degreasers from reporting, a significant amount of perchloroethylene, methylene chloride and methyl cloroform will not be inventoried unless these small emitters are accounted for in the area source totals. (Procedures for accounting for sources below cutoff levels as area sources are discussed in Reference 2.)

CHAPTER 7

GEOGRAPHIC AREA OF COVERAGE

An important consideration during the screening process regards how big a geographic area should be covered. Typically, criteria pollutant inventories cover fairly broad areas such as entire states or nonattainment areas. This extent of coverage has been necessary since criteria pollutants are ubiquitous and emitted by a diverse collection of point and area sources.

There are no well defined boundaries for air toxics inventories such as exist for nonattainment areas. Because inventorying a multitude of toxic substances can be expensive and time consuming, the relevant question is whether there are justifiable rationale for excluding certain areas from coverage in order to save resources. The answer to this question may be based on the underlying approach the agency has taken in its air toxics control program.

The most common approach in air toxics programs is to model ambient air levels around new and/or existing point sources, using source emission estimates, and then impose controls based on how much the modeled levels exceed some acceptable ambient standards or guidelines. Since the nature of this type of program is to focus solely on major point sources wherever they occur -- often regardless of the existence of other nearby sources -- the concept of excluding some areas from concern is really not germane as the entire State (or local jurisdiction) becomes the area of coverage. Thus, extent of coverage may not be an issue in this type of program.

In programs that are (1) defining relative emission strengths of small, non-permitted point sources and area sources, or (2) starting to consider the additive risks from these smaller sources along with major, permitted sources, the concept of limiting geographic coverage has more relevance. Several studies[11,27] have concluded that small sources are major contributors to aggregate incidence in urban areas; hence, this focus seems appropriate. However, due to the extra burden of compiling point source data on many smaller sources and developing area source emission estimates at an appropriate level of spatial resolution, it makes sense to try to limit the area of coverage to the extent justifiable.

This matter is an important one to consider during the planning stages of inventory development and one that a screening study can address. Those agencies that plan to compile more than a crude, aggregate inventory of small point and area sources -- especially those agencies concerned with additive risk assessments and control strategy evaluations based on risk management techniques -- should predetermine where to focus their inventory effort. Presumably, such emphasis would be placed on industrial and/or urban areas, or high risk areas therein, where the screening study indicated high emission concentratrions and/or high ambient air levels along with elevated risks.

CHAPTER 8

DETAILED DATA COLLECTION AND EMISSION ESTIMATION PROCEDURES

Chapter 3 discussed the concept of the screening inventory as a means of locating potential emitters of air toxics and developing screening estimates of emissions. The purpose of the screening study is to focus subsequent agency activities and resources on those sources, pollutants and geographic areas causing most risk. At some point in the air toxics program, the screening inventory will probably need to be refined before any control program is instituted. During this follow-up effort, more detailed and credible source data and emissions estimates will be needed, probably requiring some direct source contacts to provide this information. Various procedures are set forth in this report to help those agencies going beyond the screening inventory. In this regard, some of the approaches for compiling the detailed inventory will be the same as or extensions of those used for screening. For example, the location of sources will largely be the same, using the basic tools outlined in Chapter 3. The major differences are in compiling detailed source data and making emission estimates.

8.1 Locating Sources

Since most sources of air toxics substances should already be in the criteria pollutant inventory, these sources should not have to be located again as if the agency were starting from scratch. Instead, the agency needs only to associate emissions of specific air toxic compounds of interest with existing sources in the existing inventory. As mentioned before, certain "nontraditional" sources may not be included and certain sources may be excluded because their VOC were considered photochemically nonreactive. Two important nonreactive VOC of particular interest are methyl chloroform (1,1,1 trichloroethane) and methylene chloride.

Many of the screening tools outlined in Chapter 3 will be appropriate for use in locating sources in the detailed inventory and, thus, are not repeated here. Since none of these screening tools requires source contacts, some errors will occur in identifying actual emitters of particular toxic substances. One additional locating tool that some agencies employ that involves making source contacts is the production/use survey. Some agencies have utilized production/use questionnaires which basically just ask sources to identify whether each substance is purchased, used or produced. From this, the agency may decide which facilities should receive a more detailed, followup questionnaire.

In general, the emphasis in the detailed inventory will not be on locating sources, since this has presumably been done in the screening process. This step will be necessary, however, where the agency has foregone the screening process.

8.2 Data Collection

Before sending out questionnaires or making plant visits, the agency should carefully evaluate the need to contact all sources. Based on the results of the screening study, certain sources may have such low emissions or pose such little risk that further information would not prove useful. Or, in some cases, the screening estimate developed by the agency based on material balances or emission factors may prove as accurate as any estimates likely to be provided by certain industrial segments. The latter may be the case for small solvent users and combustion sources. For those sources where the agency believes it needs more information, data collection may proceed using questionnaires, plant visits, etc., just as with any criteria pollutant. A great deal of data can also be obtained through the new source review and permit renewal process.

(a) Use of questionnaires

As mentioned previously, a fundamental decision that has to be made during planning is whether the questionnaires should be open-ended or directed toward a limited number of compounds. This decision will affect both the design of the questionnaires and the nature of data collected. In general, if a directed approach is taken, and the number of compounds is kept to a minimum, the resulting number of source contacts that has to be made can be greatly reduced. Moreover, the quality of the data received may also improve -- especially if the questionnaires can be tailored to the principal source categories of concern. Data collected from industry-specific questionnaires will not only be more accurate for the respondant sources themselves, but will also allow the agency to develop emission factors and emission-to-employee ratios to apply to other, perhaps nonresponding, sources in the same source categories. Of course, tailoring questionnaires to specific industries can be costly and time consuming unless another agency's questionnaires can be adopted. This time and effort may be recovered since less followup will often be required.

Conversely, if one uses the open-ended approach and is not targeting information on specific sources or a limited group of compounds, a much larger number of contacts will be necessary using questionnaires that are more generic in design. This approach may require less time and effort for questionnaire design, but the resulting responses may be commensurately less detailed and possibly not as useful. For example, if an agency is conducting an open-ended survey of air toxics associated with solvent use, a fairly general survey form will have to be sent out to a large number of coaters, degreasers, printers, drycleaners, etc., with a voluminous and varied response expected. As mentioned previously, a particular danger in this type of survey is that many (especially smaller) sources may simply report trade names of solvents, coatings, etc., or may not report anything at all if they don't know what compounds are present in the materials they use. Either possibility can lead to underreporting and an underestimating of substance use and emissions by the sources and the inventory agency.

Various kinds of questionnnaires have been developed to collect air toxics emissions data, with some being quite detailed and others being very general. EPA has developed several questionnaires to collect long and short term release information from major organic chemical manufacturers as background for setting NESHAPs under Section 112 of the Clean Air Act. The long term questionnaire asks for annual emissions from process vents, fugitive equipment leaks, equipment openings, raw material/product storage and handling, secondary waste treatment, and liquid spills. The short term version covers the same sources but focuses on above-average emissions from relief valve vents, bypass of control devices, startup and shutdown, accidental releases or any other event, routine or otherwise. Because of this extreme detail, a questionnaire of this type would most likely only be used by an agency to collect information on a handful of very large, singularly important point sources. Obviously, a great deal of effort would go into filling out a questionnaire of this complexity as well as into interpreting the response.

In contrast, many agencies will employ a more general questionnaire that is not tailored to a specific type of source or one particular substance. Such a questionnaire may be more appropriate when an agency needs information quickly, albeit of a more "broad brush" nature. An example of such a questionnaire is included in Appendix J. Extending this concept, at least one agency is preparing questionnaires tailored to several key industries within the State.

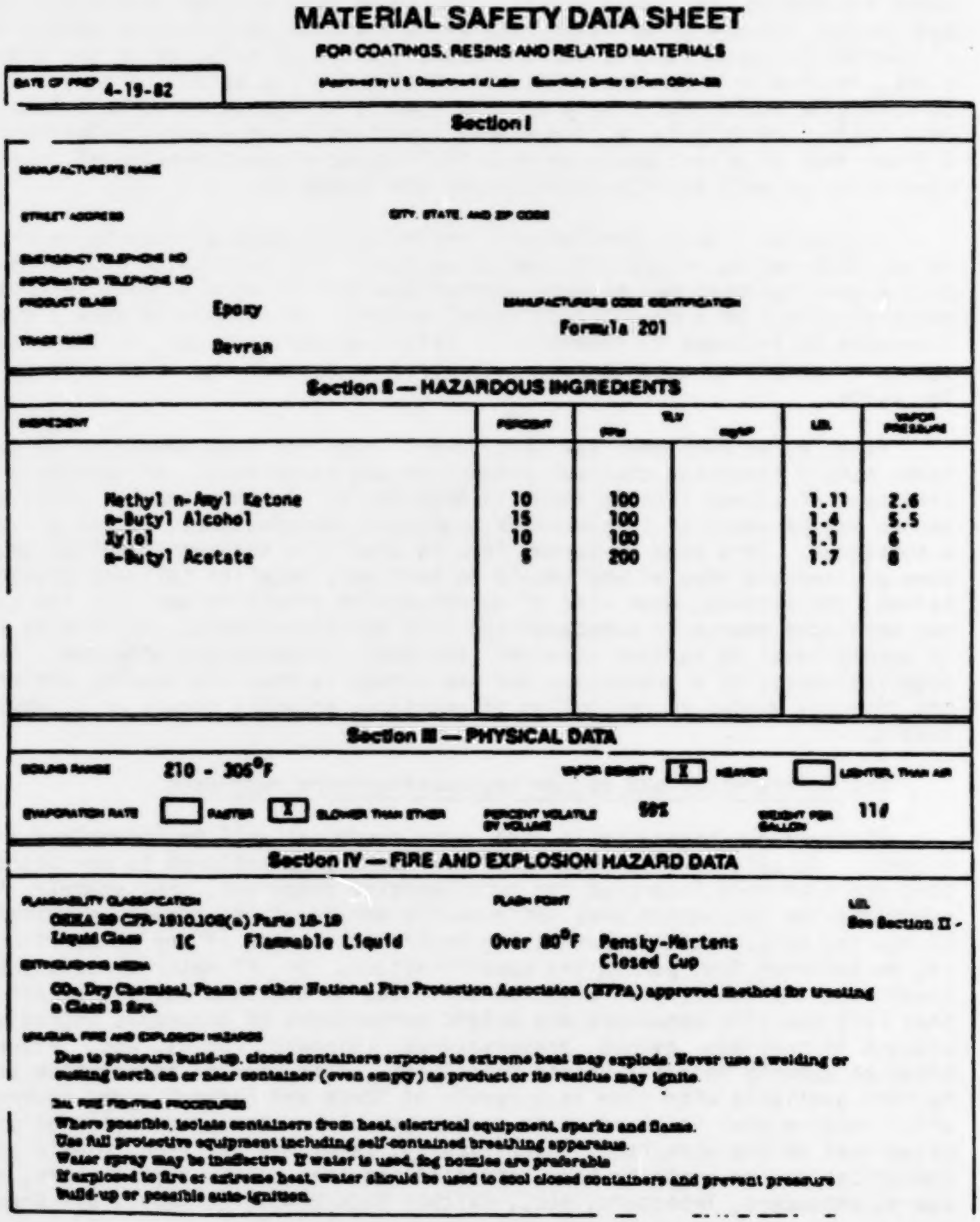
Finally, as mentioned earlier, several agencies have developed survey forms simply targeting chemical production and usage data. An example of this type of survey form is shown in Appendix K. In this type of form, each source may be asked if it purchases, packages, manufactures, stores or uses a substance. This kind of survey form is used as a screening tool to get some preliminary idea of who should be sent more detailed followup questionnaires, and perhaps, what kind of questionnaire should be sent (if the agency has developed source or substance specific questionnaires). It is also used to supply input to various agencies' emergency preparedness programs. One negative aspect of a production and use survey is that the results are often not directly useful in projecting if emissions actually occur, or at what levels.

(b) Interpreting and augmenting questionnaire responses

Whatever questionnaire is used, some responses will be incomplete and/or suspect. To this end, several other avenues may be explored to corroborate, complement or help interpret the questionnaire responses. For example, if the questionnaire respondant does not know the makeup of its company's emissions, it may pay to contact his purchasing department to see if any composition data can be inferred from purchasing specifications. Or, if Material Safety Data Sheets are available, they might be solicited in the data collection effort as they list specific compounds and weight percentages of hazardous ingredients present in coatings, paints, preservatives, thinners, resins, etc. Figure 1 shows an example Material Safety Data Sheet. This kind of information should be more available with time as a result of State and Federal right-to-know laws which require that information be made available on the composition of products being used in the workplace. Specifically, as of May 25, 1986, OSHA's Hazard Communication, or right-to-know, standard requires users, distributors, repackagers, producers, importers, etc., (within SICs 20-39) to supply all known

FIGURE 1

Sample Material Safety Data Sheet



MATERIAL SAFETY DATA SHEET

FOR COATINGS, RESINS AND RELATED MATERIALS

(Approved by U.S. Department of Labor "Essentially Similar to Form OSHA-20")

DATE OF PREP 4-19-82

Section I

MANUFACTURER'S NAME

STREET ADDRESS CITY, STATE, AND ZIP CODE

EMERGENCY TELEPHONE NO

INFORMATION TELEPHONE NO

PRODUCT CLASS Epoxy MANUFACTURER'S CODE IDENTIFICATION Formula 201

TRADE NAME Devran

Section II — HAZARDOUS INGREDIENTS

INGREDIENT	PERCENT	TLV PPM	TLV mg/M³	LEL	VAPOR PRESSURE
Methyl n-Amyl Ketone	10	100		1.11	2.6
n-Butyl Alcohol	15	100		1.4	5.5
Xylol	10	100		1.1	6
n-Butyl Acetate	5	200		1.7	8

Section III — PHYSICAL DATA

BOILING RANGE 210 - 305°F VAPOR DENSITY ☒ HEAVIER ☐ LIGHTER THAN AIR

EVAPORATION RATE ☐ FASTER ☒ SLOWER THAN ETHER PERCENT VOLATILE BY VOLUME 50% WEIGHT PER GALLON 11#

Section IV — FIRE AND EXPLOSION HAZARD DATA

FLAMMABILITY CLASSIFICATION

OSHA 29 CFR-1910.106(a) Parts 18-19

Liquid Class IC Flammable Liquid

FLASH POINT

Over 80°F Pensky-Martens Closed Cup

LEL

See Section II -

EXTINGUISHING MEDIA

CO₂, Dry Chemical, Foam or other National Fire Protection Association (NFPA) approved method for treating a Class B fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS

Due to pressure build-up, closed containers exposed to extreme heat may explode. Never use a welding or cutting torch on or near container (even empty) as product or its residue may ignite.

SPECIAL FIRE FIGHTING PROCEDURES

Where possible, isolate containers from heat, electrical equipment, sparks and flame.
Use full protective equipment including self-contained breathing apparatus.
Water spray may be ineffective. If water is used, fog nozzles are preferable.
If exposed to fire or extreme heat, water should be used to cool closed containers and prevent pressure build-up or possible auto-ignition.

Note: Companies are allowed to use any reporting format as long as the necessary data are contained. Hence, differing formats would be expected from most companies.

hazard data, including species composition data and some toxicity data, on Material Safety Data Sheets.[28]

State OSHAs can also be a valuable source of information even though the Federal Hazard Communication standard supercedes States' right-to-know laws. For example, some State agencies may have collected workplace ambient air samples that could suggest what air toxics are being emitted. Also, these agencies may have information on compositions of trade name products.

Various published product indexes and formularies contain information product compositions that could assist in this regard. The Colour Index,[29] Pesticide Index,[30] and Formulary of Paints and Other Coatings[31] are examples of compilations of the makeup of products in certain industrial segments that may help the agency corroborate or interpret the questionnaire responses. Other publications that may be consulted for this kind of information are cited in References 32 through 35.

Finally, the National Institute for Occupational Safety and Health (NIOSH) has compiled an extensive data base containing information on the chemical composition of approximately 75,000 products from all segments of industry and commerce. This data base, called the Trade Name Ingredient Clarification File (TNIC) file, was developed by NIOSH under its National Occupational Hazard Survey from 1972-74, and contains data on both metals and organics that were obtained by NIOSH visits to the various product manufacturers. There is no report, per se, summarizing the information in this file, but NIOSH personnel will develop appropriate retrievals upon request. Any prospective user should contact the Chief of the Hazard Section at NIOSH at (513) 841-4491 or (FTS) 684-4491. It should be noted that about one-third of the product data in the TNIC file is considered confidential and therefore unavailable. NIOSH repeated this survey in 1981-83 on an expanded list of products; however, the results are not yet accessable. These data base may prove useful in matching possible pollutants with sources if more direct procedures are not successful.

Synonyms for commonly inventoried substances are presented in Appendix L.

(c) Use of information in permit applications

Many agencies have new source review and permit renewal programs that cover air toxics. These activities should be viewed as a potential source of information for use in the air toxics emission inventory. Some agencies directly incorporate certain permit conditions, such as allowable emissions, in the emission inventory.

The permit process should be viewed as a good way to collect air toxics information because of the leverage the agency has on the permit applicant. However, because the duration of many States' permit renewal cycle is typically from 3 to 5 years, the agency normally cannot use this process to develop or update the air toxics inventory quickly.

8.3 Emission Estimation Procedures

Air toxics emissions are estimated in largely the same manner as are criteria pollutant emission estimates. The two main approaches involve the use of emission factors and material balances. The use of apportioning factors, as described in Chapter 3, is generally considered more of a screening tool although it may also find some application in the detailed inventory. Source testing is another procedure that may be applicable in certain situations.

Currently, the literature contains limited information on air toxic emission factors for various substances. The main source is the EPA series entitled Locating And Estimating Air Emissions From Sources Of (Substance).[13] Another potential source of emission factor information is EPA's National Air Toxics Clearinghouse data base.[15] States and local agencies have submitted permit and source test information to the Clearinghouse that may be of assistance in determining emission rates for many kinds of industrial facilities. Contact names and phone numbers are also given, allowing the user the opportunity to get more information directly from the supplying agency. As more data are supplied, the Clearinghouse should improve as a source of emissions data. Various available emission factors are compiled in Appendix H.

The second major technique for estimating air toxics emissions is the material balance. In a material balance, emissions are determined by difference by knowing the amount of a certain material that enters a process and the amount that (1) leaves either in liquid or solid waste, (2) is contained as part of a product, (3) is sold to a recovery facility or (4) is converted to another substance. Material balance techniques are particularly useful for operations using solvents, but can also be used for metals, as well. Frequently, when doing a material balance for screening purposes, the conservative and simplifying assumption is made that all or some fraction of a solvent or metal used or consumed in a process is emitted to the air. Of course, any such conservative screening estimates may have to be refined later in the program if the inventory is going to be used for modeling or control strategy development purposes.

Source testing -- either by the agency or by the source itself -- represents a third technique for estimating air toxics emissions from a source. While source tests are generally considered to yield more accurate emission estimates than emission factors, they are not as widely employed for air toxics for several reasons. First, as with criteria pollutants, is the cost factor; source testing can be expensive. Second, validated sampling and analytical procedures are not yet readily available for many air toxics. Third, there are many situations where emission factors and material balance procedures will yield acceptable results at much less cost. Finally, there are certain sources which are not readily amenable to routine source testing, such as fugitive leaks from valves, pumps, etc., and certain intermittent operations characterized by varying flow characteristics and concentrations. Available source test methods are summarized in Reference 13 for each respective substance. Other methods may be cited in Reference 8.

The use of emission factors and material balances for estimating air toxic emissions is exemplified in Appendix A.

8.4 Control Device Applicability and Efficiency

An important consideration when calculating current emission levels, as well as when projecting emission reductions, is control device applicability. EPA has published a manual which should help agency personnel select and evaluate costs of control techniques for reducing air toxics from industrial and commercial sources.[36] A generic treatment is given both to pollutants and sources. Air toxics are categorized and handled as (1) organic vapors, (2) organic particulate (3) inorganic vapors (4) inorganic particulate. Emission sources are classified as (1) process point sources, (2) process fugitive sources and (3) area fugitive sources. General guidelines are provided that match specific control devices with specified emission stream properties (e.g., pollutant content in stream, temperature, moisture, heat content, particle size and flowrate.) Basic design parameters are then determined to provide general design conditions that should be met or exceeded for each selected control technique to achieve some specified level of control efficiency. This manual can also identify which control techniques will not meet specified reduction requirements.

8.5 Problems in Data Collection and Interpretation

The agency may encounter problems in a number of areas when compiling the air toxics inventory. Some potential problem areas are identified below.

(a) Too many substances

If the agency utilizes the open ended approach (discussed in Section 4.1) and doen not limit the number of substances, it may receive much more more information than it can adequately process and store in its data handling system. Also, it may encounter source reluctance to report on a large number of substances.

(b) No cutoff levels or exemptions

Many agencies employ cutoff levels to preclude reporting of low emission rates and/or exemptions to preclude reporting by certain sources. (See Chapter 6.) If an agency does not provide for any such exclusion, it runs the same risks as if it is trying to handle too many substances -- it may obtain more data than it can efficiently handle and it may encounter source resistance to reporting low emission levels for many substances.

(c) Nomenclature problems

Sources may report trade names or chemical synonyms that the agency may have difficulty in interpreting. In some cases, the composition of trade name products can be ascertained from the source or supplier by soliciting Material Safety Data Sheets; however, this is not always successful and such followup requires additional resources. Some of this can be avoided if the agency asks sources to report in terms of specific substances.

(d) Sources can't supply emissions data

Some sources, for various reasons, may claim not to be able to supply the agency with adequate emissions data. This may particularly be the case with smaller operations that may not have the expertise or resources to determine emissions. Such determinations may even prove difficult for some large, complicated manufacturing processes. The agency will want to consider what services, if any, it may provide to such sources, or if it will make emission estimates itself.

(e) Need for agency follow-up

Several agencies have pointed out the inevitable need for follow-up to clarify the responses from some sources or to obtain additional or missing data. This might be the case, for example, where the agency's screening estimates for a large source differ significantly from those supplied by the source, or where the agency believes a source is emitting a certain pollutant it doesn't report. The agency will probably want to hold some resources in reserve to make follow-up contacts to a fraction of its sources.

8.6 Sources of Inventory Error

As in criteria pollutant inventories, the potential exists for many sources of error in the inventory of air toxics. Some of these errors will originate with the sources supplying the data and some will be a result of the data and methods used by the agency to estimate emissions. A summary of some of these errors is given below:

- missing sources
- inaccurate/insufficient/uninterpretable data supplied by sources
- missing or inaccurate emission factors
- missing or inaccurate VOC and/or particulate matter apportioning factors
- erroneous material balance or source tests

A number of corrective measures that may be employed to reduce these errors is summarized below:

- perform follow-up visits, calls, and tests at important sources

- checks for missing sources

    - apply pollutant/source category cross indexes to criteria pollutant inventories to identify potential sources
    - check EPA emission factor and source assessment reports
    - check permit, registration, compliance, right-to-know and other State or local data bases

- check EPA publications and the EPA National Air Toxics Clearinghouse for better emission factors and apportioning factors, or develop such based on emissions data submitted for similar sources

- review material balance and source test data, making sure that all material pathways have been identified, the best test procedures have been used and the results are reconcilable with estimates based on emission factors and/or VOC or PM apportioning factors.

It is very difficult to develop rigorous, quantitative estimates of the precision and accuracy of emission inventories because many of the components are not amenable to mathematical error analysis. The best means to minimize error is to use the best data and procedures possible, within existing resources, and to subject the results to review by those that will either use the data or be affected by subsequent application thereof.

CHAPTER 9

SUMMARY

Many State and local agencies have compiled inventories of air toxic emissions or are starting to develop them. Several different directions are being taken in the design of these inventories as well as in how they are being used in the agencies' source evaluation and control programs. Because these inventories can be expensive due to the large number of pollutants that potentially can be included, careful planning is necessary -- before initiating any data collection -- to optimize the use of available resources. In this regard, all end uses of the inventories should be identified during the planning stages, realizing that the most demanding modeling and risk assessment applications will dictate how detailed and extensive the inventories must be.

If possible, some type of screening study might be performed to focus the inventory on those pollutants, sources and geographic areas that pose the greatest risk. Various tools are available to compile preliminary inventories for screening purposes without having to make extensive source contacts. These tools include EPA published emission factors, apportioning factors and source assessment documents along with existing criteria pollutant emission inventories and permit files. Federal and State right-to-know standards may also result in useful information for this purpose.

The detailed emission inventory of air toxics is compiled using the same basic techniques employed in criteria pollutant inventories. Many agencies are, in fact, directly coupling their air toxics inventory activities with their criteria pollutant programs. The data in the criteria pollutant inventory and permit system can serve as a useful starting point for developing the detailed air toxics inventory, either to help locate potential sources of air toxics or to make emission estimates therefrom. For less important sources, the agency may not need to go beyond the preliminary emission estimates made in the screening inventory; however, for more important sources, questionnaires or other direct source contacts may be necessary to determine emissions. The mechanics of making source contacts and determining emissions will be largely the same as in the criteria pollutant inventory.

Most sources of air toxics will already have been inventoried as part of particulate or VOC programs. Additional emphasis will be needed to include non-traditional sources, sources below the criteria pollutant cutoff level(s), and sources of photochemically nonreactive compounds (particularly methylene chloride and methyl chloroform.) And further spatial or temporal resolution may be needed in the air toxics inventory for certain area sources than is afforded in the criteria pollutant inventory.

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APPENDIX A

EXAMPLE APPLICATIONS OF SCREENING TOOLS

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Examples of each of the screening tools discussed in Chapter 3 of this report and how they can be applied are given in Appendix A. The screening tools described are:

- SIC/pollutant, pollutant/SIC indices
- Emission factors
- Speciation/apportioning factors
- Conservative mass balances

The strengths and limitations of each tool as related to air toxics emission inventory development and permitting/new source review are discussed. For either of these applications, the objectives of using a screening tool are:

- To identify potential toxic air pollutants associated with a source category;
- To estimate the quantity of air toxics emissions; and
- To focus or direct follow-up, detailed analyses.

Using combinations of each of the four types of screening tools can allow State/local agencies to reach these three objectives.

A.1 USE OF SIC/POLLUTANT INDICES

In this section, uses of several SIC/pollutant indices are discussed. Examples are provided for use of the indices alone and in combination with other screening tools. The actual indices are presented in Appendices C, D, F, and G. Appendix E lists brief descriptions of each four digit SIC code.

While the indices provide an indication of the pollutants reasonably anticipated to be associated with a given SIC code, they do not provide definite proof that the pollutants are emitted. One limitation of using the

SIC/pollutant indices is that any given source may emit one, all, or none of the pollutants listed in the index. A source may emit other pollutants not covered in this report or not permitted by reporting agencies. An example of one method to overcome this limitation is provided.

Example: Identification of Potential Emitters of Air Toxics

A State air pollution control agency needs to determine which toxic pollutants are emitted in the State.

As a first step, the agency could identify the source categories in the areas of concern by SIC code: for example, pharmaceutical manufacture, 2834; medicinal chemicals and botanicals, 2833; commercial gravure printing, 2754; and gray iron foundries, 3321. The existence of these sources may have been determined from an existing criteria pollutant inventory or permit/registration file. The SIC/pollutant index (Appendix C) shows 10 pollutants potentially associated with SIC 2833, 22 with SIC 2834, 8 with SIC 2754 and 9 with SIC 3321. Based on this information, the agency could decide to inventory these pollutants.

Alternatively, a pollutant/SIC index (Appendix D) could be used to identify potential emitters of air toxics. Appendix D lists associations between pollutant (in alphabetical order) and SIC code. If an agency has selected pollutants of concern, Appendix D would show the SIC codes of potential emitters of those pollutants. For example, asbestos is shown in Appendix D to be associated with six SIC codes.

Appendices F and G provide additional associations between pollutants and source category (by description of source category). Appendix G includes correlations between pollutant and area sources. The information in Appendices F and G is not necessarily different from that in Appendices C and D. It simply represents information in different formats and may be more useful to agencies that cannot or do not choose to base the source category/pollutant correlations on SIC code.

For example, if an agency is interested in determining what types of pollutants are associated with the petroleum refining industry, a review of Appendix F shows that 46 pollutants or classes of pollutants are likely to be emitted. Also, Appendix F provides somewhat more detail about the specific processes or point/fugitive/area sources than do the other indices.

Appendix G also shows potential associations between pollutants and source categories. If an agency needed to determine potential emitters of acrylonitrile, consulting Appendix G shows that five processes are potentially associated with acrylonitrile emissions.

Appendix F and G may be useful in overcoming the primary limitation (lack of specificity) of the SIC/pollutant and pollutant/SIC indices. Suppose an agency needs to determine if sources in the State or region emit acrylonitrile. The agency might first check Appendix D. Appendix D indicates that sources in 11 SIC codes may be emitting acrylonitrile. The agency could then check their existing criteria pollutant inventory to determine if sources in the 11 SIC codes were located in the State or region. Suppose the agency identifies five sources in SIC 2869, an SIC code for SOCMI plants. The agency may need to further determine which type of sources in SIC 2869 are potential acrylonitrile emitters. Appendix G lists more specific processes, such as modacrylic fiber production and ABS resin production, as potential sources of acrylonitrile emissions.

The preceding example shows that the SIC/pollutant and pollutant/SIC indices may not be as useful in identifying pollutant-source associations in some SIC codes as others. For example, for the Synthetic Organic Chemical Manufacturing Industry (SOCMI), many pollutants are listed with SIC codes 2865 and 2869. To determine the specific pollutants associated with a particular source will probably require further independent research. But the SIC/pollutant and pollutant/SIC indices do provide an indication of the types of pollutants potentially emitted and serves as a starting point for more investigation.

A.2 USE OF EMISSION FACTOR LISTING

A.2.1 Example Uses of Emission Factor Listing

When source-supplied data are not available for a facility, emission factors are useful tools for making emission estimates. Emission factors may also be used to cross check data submitted by a source during the permitting process. The list of emission factors in Appendix H was compiled chiefly from EPA documents. When estimating emissions of air toxics, the table may be used as a "default" source of data when access to the primary literature is not possible. Examples of how the factors may be used are shown in this section.

Example: Preparation of Air Toxics Emission Estimates

Suppose an agency has decided to prepare a quick, preliminary inventory of sources in SIC codes 2834 and 3321. To illustrate use of the SIC/pollutant index (Appendix C) and the emission factor table (Appendix H), emissions from one facility in each source category will be discussed.

For gray iron foundries, the SIC/pollutant list (Appendix C) shows arsenic, cadmium, beryllium, lead, chromium, nickel, manganese, xylene and acetaldehyde as possible pollutants from SIC 3321. The emission factor list (Appendix H) shows emission factors, as follows, for cast iron/gray iron:

As	0.01-0.02 lb/ton metal charged
Mn	0.003 lb/ton metal charged, baghouse control
	0.075 lb/ton metal charged, impingement scrubber
	0.25 lb/ton metal charged, uncontrolled
Ni	20 lb/ton nickel charged, uncontrolled
Be	0.00044 lb/ton produced
Cr	0.03-0.09 lb/ton carbon steel produced
Cd	0.003 lb/ton carbon steel produced
Pb	0.1-1.1 lb/ton produced, uncontrolled

Note that some emission factors (chromium and cadmium) are for carbon steel production. Because this inventory method is intended to provide a basic, "rough estimate" type inventory, use of emission factors for similar, if not identical, processes may be acceptable, and necessary, if a preliminary estimate is required.

Using these emission factors, along with information from permit applications or inspection reports, the agency could estimate emissions of these metals. The information needed from criteria pollutant inventories, permits, or inspection reports includes amounts of metal charged or amounts of metal produced. If the data are not available, the model plant approach may be used to help estimate emissions. Many source assessment documents provide descriptions of small, medium and large plants, in terms of product produced or raw materials used. The agency could estimate the size of the plant in their area and obtain approximate production/raw material data. Then the emission factor could be used to quantify emissions.

The organics listed in the SIC/pollutant index for gray iron foundries are likely the result of core baking and mold drying and, perhaps, degreasing. No emission factors were found during this work effort for VOC from core baking. Methods of estimating emissions without emission factors will be discussed in the next section.

To estimate emissions of toxic pollutants associated with pharmaceutical manufacture (SIC 2834), the SIC/pollutant index should be consulted. The list shows that 22 pollutants may be found in emissions from a pharmaceutical plant. Next, the existing criteria pollutant inventory, permit files, or inspection reports should be checked to determine the products, processes and raw materials used at the specific plant. Suppose this search indicated that carbon tetrachloride and chloroform were used at the plant. The emission factor list (Appendix H) provides the following factors:

Carbon tetrachloride	100 kg/Mg used
Chloroform	160 kg/Mg used

Based on material usage records (from permit applications or inspection reports) and these emission factors, the agency could estimate emissions of these two chemicals.

Example: Permitting and New Source Review

Suppose that the permitting staff needs to know what types of pollutants may be associated with emissions from a new furniture manufacturing plant and a new printing facility. Using the SIC/pollutant index (Appendix C), the permitting staff would note that emissions from plants in SIC 25 (furniture manufacture) are generally associated with solvents, and that emissions from printing (SIC 27) are associated with solvents and metals. The emission factor list (Appendix H) shows no applicable factors for these two industries. Even though no emission factors were available in Appendix H for printing and furniture manufacture, the permitting staff would have identified potential pollutants and would be more aware of the types of chemicals about which to request information from the source. References listed throughout this report and the appendices, such as source assessments and source surveys could provide useful data on approximate emission quantities for model or hypothetical plants. Examples of how the permitting staff could estimate possible emissions from the two new plants will be presented in Section A.3.

A.2.2 Limitations of the Emission Factor Listing

The table in Appendix H provides emission factors that can be used to obtain quick, rough estimates of toxic pollutant emissions for both inventory development and permitting/new source review. However, more detailed data on the pollutant emission sources can be found in the primary literature references discussed in this section. The primary limitation of using just the emission factor listing is that the development of the factors is not shown in the table and the exact applicability is not certain. Consulting the primary references, in addition to using the emission factor listing, can provide a more accurate emissions estimate.

A.3 USE OF SPECIES (APPORTIONING) FACTORS

Another technique that may be used to estimate emissions of air toxics is to apply species or apportioning factors to existing estimates of particulate matter (PM) or volatile organic compounds (VOC). Examples are presented in this section of the use of species factors from three different sources of information.

A.3.1 VOC and PM Speciation Manuals

Two major speciation references are currently available, one for volatile organic compounds and one for particulate matter. The VOC species manual (EPA, 1980) shows percent by weight and percent by volume of specific chemicals in emissions from specific processes. The sources covered in this manual include point and area sources, and SCC codes are presented where applicable. The manual for particulate matter (EPA, 1984) was designed to provide particle composition data for receptor model applications, but the composition data are useful for air toxics emission inventory work as well. The manual lists composition as percent by weight for specific metals, organic carbon and elemental carbon for particulate emissions from point and area sources. SCC codes are provided when applicable. Examples of how these tables may be used in air toxics emission inventory work are described in this section.

Example: Quantifying Species in Particulate Matter Emissions

Suppose that an agency wished to identify the particular elements that comprise the particulate matter emissions from a glass furnace. The Receptor Model Source Composition Library document (EPA, 1984) lists species present, on a weight percent basis, in total suspended particulate (TSP) emissions from a glass furnace at a recycling plant (Profile Number 27102). Twenty-nine specific metals are included in this particular source's emissions, including arsenic. By consulting the criteria pollutant inventory to obtain the quantity of PM emissions in tons per year, the agency could estimate the amount of toxic pollutants emitted. If the total PM emissions of the subject plant were 150 tons per year, and, the arsenic content of PM emissions was 0.023 percent (by weight) from the Profile Number 27102, the estimated arsenic emissions would be 150 tons/year x 0.023 percent or 0.035 tons per year. Similarly, the receptor model source composition library (Profile Number 27102) shows that TSP from the glass furnace total about 0.218 percent, by weight, chromium. If total PM emissions were 150 tons per year, then estimated chromium emissions would be 0.33 tons per year.

Although TSP is not identical to particulate matter, the analogy between the two can be drawn and is useful for screening purposes. This is especially true for many sources where most particulate matter is comprised of TSP, PM-10 or fine particulate fractions.

Before applying the species profile data for arsenic, the agency would need to verify the type of glass produced at the plant. Not all types of glass production use arsenic and different forms of arsenic are used in different glass manufacturing processes. These data may be obtained from permit applications, inspection reports, or registration files.

Example: Quantifying Species of Volatile Organic Compounds

An agency could estimate emissions of solvents from a commercial printing facility by using the VOC species manual (EPA, 1980). The manual lists xylene and toluene as emissions from a commercial gravure printing press. Toluene accounts for 13.0 percent by weight and xylene (all isomers) for 4.0 percent by weight. Based on the total VOC emission from the criteria pollutant inventory, estimates of the two species (pollutants) can be made. If a commercial printing facility emitted 100 tons per year VOC, then based on data from the species manual, toluene emissions would total 13 tons per year and xylene, 4 tons per year. The estimates generated using this technique would only be expected to be preliminary because formulations of inks and cleaners will vary at different facilities. The agency could contact the source to verify types of solvent used as part of a detailed inventory development effort.

Example: Use of Apportioning Factors from the Literature

Species profiles such as those available in work performed for California's South Coast Air Basin (SAI, 1984) can be used to estimate emissions. For example, the SAI document (Improvement of the Emission Inventory for Reactive Organic Gases and Oxides of Nitrogen in the South Coast Air Basin) lists VOC species profiles for typical primer coating by percent weight (Figure A-1). A typical primer may contain, according to this reference, 44.3 percent (weight) toluene, 1.45 percent (weight) all isomers of xylene and 2.23 percent (weight) o-xylene. Using total VOC emissions from the criteria pollutant inventory, the emissions of toluene and xylene from primer use could be quantified.

Chemical Name	Weight Percent
Heptane	1.94
Methylcyclohexane	2.50
Toluene	44.30[a]
Isomers of nonane	3.45
Dimethylcyclohexane	6.26
2,4-Dimethylhexane	11.09
N-butyl acetate	8.42
Dimethylheptane	1.04
Ethylcyclohexane	2.08
Trimethylcyclohexane	2.43
Isomers of xylene	1.45[b]
o-Xylene	2.23[b]
2,4-Dimethylpentane	2.66
Butyl cellosolve	10.13
TOTAL	99.98

[a] Used for estimating toluene emissions.

[b] Used for estimating xylene emissions.

Figure A-1. Sample Species Profile for Primer (Source: SAI, 1984).

Assume that the primer listed above is the only coating used and that the plant in question emits about 50 Mg VOC per year. For a rough estimate of emissions, it can be assumed that all solvent in the coatings used is emitted. Then solvent emissions may be quantified as follows for primer use:

Primer: 50 Mg/year emitted x 0.443 = 22.2 Mg/year toluene
50 Mg/year emitted x 0.037 = 1.9 Mg/year xylene

Note that the percents by weight for o-xylene and all isomers of xylene were summed for total xylene.

These techniques may also be used in evaluating new sources and permitting by making assumptions about potential total VOC emissions or by using data from the permit application. The "worst case" estimate of emissions could be made by using the highest percent (weight) for the toxic pollutant of concern found in any species profile.

A.3.2 Material Safety Data Sheets

Suppose an agency needs to speciate VOC emissions from a furniture manufacturing plant. When reviewing permit application files for the source, the agency found information indicating that Supplier X's Enamel 209 and Primer 387 were the raw materials used at the plant and also found that Material Safety Data Sheets for these two products were included in the files. Safety data sheets generally list the composition of the material by percent weight (Figure A-2).

By obtaining total VOC emissions for the plant from the criteria pollutant inventory and/or permit applications, the emissions of specific toxic pollutants can be estimated using the information on the safety data sheet. If the data in Figure A-2 represent the enamel and primers used at the plant, and assuming that the plants total VOC emissions were 50 tons per year, then 7.3 tons per year toluene and 1.9 tons per year of xylene would be an estimate of the air toxics emitted.

II HAZARDOUS INGREDIENTS

MATERIAL OR COMPONENT	%	HAZARD DATA
Toluene	14.5(w)	
Xylene	3.8(w)	
Ethyl acetate	5.9(w)	

Figure A-2. Sample Material Safety Data Sheet: Hazardous Ingredient Section.

A.3.3 Limitations of Using Species and Apportioning Factors

The primary limitations when using species factors are that (1) materials used at each facility will vary, and (2) speciation data are not available for all source categories. For example, a surface coating operation may be known to use varnish and lacquer, but the specific type and its composition are not known. The apportioning factors can be successfully used to get a rough emissions estimate of specific pollutants. That level of accuracy may be all that is needed for screening purposes. If a more detailed analysis is needed, the source could be contacted to obtain safety data sheets for specific materials used. The same calculation methods presented here could then be made using the site-specific species data.

A.4 USE OF CONSERVATIVE MATERIAL BALANCES

A material balance can be used to estimate emissions from processes where emission factors, speciation data, or source assessment data are not available. Even where these other tools can be used, the material balance may be the best approach in some situations. The simplest material balances (most conservative) are those that assume most or all of a material used or fed into a process is emitted to the atmosphere. In many cases, this assumption will overestimate emissions; however, for screening purposes, such an assumption may be reasonable. Examples of how a material balance may be used to estimate emissions are provided in this section.

Example: Estimating Emissions of VOC from Air Stripping of Contaminated Groundwater

Suppose that an agency needs to estimate emissions of two solvents (1,1,1-trichloroethane and carbon tetrachloride) from an air stripper used to decontaminate groundwater. Using simple material balances based on concentrations of the solvents in the groundwater and the operating parameters of the air stripper, emissions (lb/hr) of the two solvents can be estimated.

Assume that the groundwater concentrations of the two solvents were:

1,1,1-Trichloroethane	38 mg/l
Carbon tetrachloride	12.6 mg/l

Then assume that all of the solvent contained in the groundwater is emitted to the atmosphere and that the stripper cleaned 50,000 l of water per hour. Then emissions could be estimated for 1,1,1-trichloroethane as follows:

50,000 l water/hr x 38 mg solvent/l x 1 lb/454 g x 1 g/1000 mg =
42.1b solvent emitted/hr

Similarly, the estimated emissions of carbon tetrachloride would be 1.4 lb emitted/hr.

Example: Estimating Emissions of Metals and Organics from Waste Oil Combustion

Suppose that an agency needed to estimate the area-wide emissions of cadmium, chromium, and perchloroethylene from waste oil combustion. Using simple material balances based on the concentrations of metals and organics in the waste oil and the amount of waste oil burned annually, and by estimating the amount of metals and organics contained in the flyash, emissions (tons/year) can be estimated.

Assuming that about 75 percent of the metals in waste oil are emitted (conservative estimate from the general literature), 739,000 gallons of waste oil are burned per year and the oil contains 2.7 mg/l cadmium, the emissions could be estimated as follows for cadmium:

739,000 gal waste oil burned/yr x 2.7 mg Cd/l waste oil x 75% metal emitted x
2.785 l waste oil/gallon waste oil x 1 g/1000 mg x lb/454 g x 1 ton/2000 lb =
0.006 ton/year Cd

For chromium, the emissions would be 0.085 tons/year, based on 37 mg Cr/l in waste oil.

For perchloroethylene, assume that 1 percent of the organics in waste oil are emitted (99 percent destruction), then:

739,000 gal waste oil burned/year x 448 mg perc/l waste oil x 1% organic emitted x 3.785 l waste oil/gal waste oil x 1 g/1000 mg x 1 lb/454 g x 1 ton/2000 lb = 0.014 ton/year

A.4.2 Limitation of Conservative Material Balance Use

For processes where reasonable assumptions can be made about the fate of a pollutant during the process, the conservative material balance provides a reasonable first estimate of emissions for screening. For processes where a material is reacted to form a product or otherwise significantly chemically changed, the conservative material balance technique is not appropriate. Consulting the literature for more detailed data about the process may provide enough information to allow assumptions to be made about the emission of a specific pollutant.

APPENDIX A REFERENCES

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APPENDIX B

AIR TOXICS EMISSION INVENTORY ISSUES: DISCUSSIONS WITH STATE AND LOCAL AGENCIES

APPENDIX B

AIR TOXICS EMISSION INVENTORY ISSUES:

DISCUSSIONS WITH STATE AND LOCAL AGENCIES

This Appendix presents the results of conversations with various State and local agencies on what approaches they have taken in compiling inventories of air toxic emissions and how they have resolved important issues. These conversations were held between two EPA contractors, Engineering-Science (E-S) and Radian, and various State and local agency personnel in the spring of 1986. The questions and issues listed in Table B served as a focal point for the discussions. (In some cases, E-S and Radian reflected information obtained directly through working with these agencies.) EPA personnel did not partake in these discussions and, as such, cannot verify the accuracy of any statements herein.

Table B at the end of this appendix may serve as a useful checklist for those planning or just starting an air toxics emission inventory.

EPA's National Air Toxics Information Clearinghouse database (NATICH) has been expanded to include specific information on State/local emissions inventories. This information in available through NATICH Interactive Report 20 and includes agency-specific details on the data collection methodology used, (e.g., via permits or questionnaires), on the types of data collected (e.g., stack and control device information), and presents the annual emissions of the pollutants inventoried. This information is presented through the NATICH data base for users with computer access and is also available as a hardcopy report. This information may be expanded on through the use of the Agency contact names and telephone numbers. The inventory data base will be updated regularly as State and local agencies supply information to EPA.

STATE DISCUSSIONS OF ISSUES

B.1 Pollutant Selection

Several different methods of selecting toxic air pollutants have been used by the agencies. These approaches are described in the following paragraphs. More detail is given in Reference B-1.

The Nevada-Las Vegas Clark County Air Pollution Control Division initiated its toxic emission inventory to satisfy State regulatory standards. This local Agency inventories those substances regulated by the State of Nevada which are prevalent in the county. This list includes about 20 substances.

The Puget Sound Air Pollution Control Agency uses an "open-ended" approach for selecting the substances to be inventoried. All sources in the region were requested to submit Material Safety Data Sheets for any material used or produced at their facilities. Emission information was requested during the annual source registration for all the materials listed on the submitted Material Safety Data Sheets that are emitted at a rate in excess of 1 ton/year.

Washington Department of Ecology's Office of Hazardous Substances and Air Quality Control currently inventories about 50 toxics. These 50 substances were selected by a preliminary screening study which identified those substances which are most likely to be emitted in the State. From this preliminary screening study list the State eliminated those pollutants for which no emission factors or emission information existed. The remaining pollutants were then evaluated for their toxicity and emission potential. Substances having a fairly low toxicity and that were potentially emitted only in small quantities were eliminated from the inventory list.

The Massachusetts Department of Environmental Quality Engineering's Division of Air Quality Control has just recently initiated an air toxics emission inventory. Compounds initially selected for the inventory included the 379 chemicals listed in EPA's Chemical Emergency Preparedness Program Interim Guidance (Reference B-2) and 1,600 substances included in the State's right-to-know program. Other substances are being evaluated for inclusion through an assessment of health effects data. The final inventory is expected to include approximately 2,000 to 2,500 substances.

The Texas Air Control Board list of toxic air pollutants evolved over several years. Initially, a list was comprised of common substances identified in EPA and other State and local regulatory Agency toxic lists. This list has been refined to include 167 chemicals which are known to be emitted in the State in signficant quantities. Chemicals are added to the existing list through the Agency's permit system. Permit applications must identify all chemicals that will be emitted from the source(s) under consideration. The Agency runs a screening dispersion model to determine if the emissions will result in ambient concentrations above published occupational limits. The Health Effects Evaluation Research Section evaluates the health risks of those substances for which an exposure limit is exceeded to determine if it should be included as an air toxic. Substances are evaluated based on occupational exposure limits published by the American Conference of Governmental and Industrial Hygienists (ACGIH), Occupational Safety and Health Administration (OSHA) and National Institute for Occupational Safety and Health (NIOSH). When no exposure limit is available, other health effects data are used in the evaluation.

The New York State Bureau of Air Pollution Control inventory has been developed through its permit system. Every air pollution source in the State must be registered annually with the Agency through a permitting process. Each permit application must include an estimate of the quantity of each substance expected to be emitted from the source for which a permit is being sought, regardless of the substance's toxicity. Each substance identified by the applicant is included in the New York toxic emission inventory. Currently there are about 3,000 substances included in the inventory.

In 1984, the Maine legislature mandated the Bureau of Air Quality Control to complete a toxic air pollutant inventory. A list of 199 pollutants was developed with the assistance of the Northeast States for Coordinated Air Use Management Council and the Maine Bureau of Health.

The Minnesota Air Pollution Control Board initially adopted the list of 37 potentially toxic substances published by EPA for high priority NESHAP consideration. It has since added to this list, five NESHAP pollutants (asbestos, benzene, mercury, radionuclides, and vinyl chloride). Thus, there are currently about 42 substances inventoried.

The California Air Resources Board works with the State Department of Health Services to identify substances as air toxics through an elaborate health impact assessment. When there is scientific uncertainty in the health effects data for a substance, the data is submitted to a Science Advisory Committee for review and evaluation to help determine whether the substance should be listed as a toxic. Substances included in the initial evaluations were selected through a review of other available lists, such as the EPA list of 37 chemicals given priority for NESHAP study and lists developed by other State agencies. Pollutants have been prioritized for the toxicity assessment based on the availability and quality of toxic information on the pollutants. Once a substance is identified as an air toxic, the regional agencies (Air Quality Management Districts) are then responsible for inventorying emissions of the substance.

Hudson County, New Jersey Regional Health Commission inventories approximately 143 toxics which were selected through an adverse health effects evaluation using data from the NIOSH Registry of Toxic Effects of Chemical Substances (RTECS). A substance was included in the list if it was a potential carcinogen, mutagen, teratogen, or is considered acutely toxic.

Rhode Island's Department of Environmental Management currently inventories 125 substances. The substances were selected from other State lists and carcinogenic chemical lists. The Northeast States for Coordinated Air Use Management Council assisted the Agency in developing the list.

North Carolina's Division of Environmental Management has completed a preliminary inventory survey to identify which toxic substances and which sources should be included when its inventory is developed. A list of 67 compounds has been generated from other agencies' lists. (This list has since been expanded to 81 substances.) A pollutant/source crosswalk was used to select 67 compounds from the several Agency lists reviewed. North Carolina feels that a targeted list is a better approach than an "open-ended" request for toxic information and recommends the approach to other State and local agencies.

Iowa's Department of Water, Air and Waste Management is currently in the preliminary stages of its air toxic emission inventory. The pollutants selected for screening purposes are primarily the Resource Conservation and Recovery Act (RCRA) hazardous constituents listed in Appendix VIII of 40 CFR Part 261. Some substances common to certain nontraditional sources, such as landfills, and several toxics commonly listed by other agencies, but not on the RCRA list, were also included. Upon completion of the list, approximately 400 substances are expected to be identified.

B.2 Source Selection

Nevada-Clark County includes sources for its toxics inventory through the permitting process. New sources are included in the inventory when they are granted their initial 5-year operating permit. Existing sources are required to report toxic emissions when they apply for renewal of their 5-year operating permit. Sources which are not currently permitted, but are thought to be emitting more than 1/4 pound of a toxic pollutant per 8-hour period, will be investigated by the Agency. Area and nontraditional sources are not included in the inventory.

Massachusetts includes sources for its toxics inventory through its criteria pollutant source registration program. All stationary sources which emit over 100 tons per year of a regulated air pollutant are sent a registration form annually. These sources are now being asked to report toxic emissions on the registration forms. Regional offices within the State are responsible for inspecting sources within their jurisdiction and assuring that sources are properly registered. No area sources or point source which emits less than 100 tons per year of any regulated pollutant are currently included in the State's Stationary Source Emissions Information System (SSEIS).

Puget Sound also incorporates sources of toxic emissions through its annual registration system. As in Massachusetts, sources are required to report toxic substance emissions on registration forms. The inventoried sources are basically point sources. Initially, a 1 ton per year point source cutoff level was established for toxics, but this level is now considered to be too restrictive because the inventory was too small. A much lower cutoff level is now being studied.

The Washington Agency uses its criteria pollutant emission inventory to identify potential toxic emitting sources in the following manner. Sources are requested to identify the constituents of their VOC process emissions. The Agency than applies emission factors, when possible, to estimate the emissions of the toxic components. Emissions of less than 5 tons per year of a toxic pollutant are catalogued as an aggregated source. The inventory contains about 800 individual listed sources, while over 2000 sources make up the estimated total emissions of each toxic substance. A list of area sources is also included in the inventory, including gasoline evaporation losses, dry cleaners, automotive gasoline combustion, and others.

Texas inventories about 1000 major sources within the State, including area and nontraditional sources. All existing sources included in its criteria pollutant inventory were asked to report toxics. The sources are required to identify the constituents of their VOC emissions. Emissions from nontraditional sources, such as wastewater treatment plants, cooling towers, valves, pumps, and flanges, are included in the inventory. New sources are incorporated into the inventory through the new source permitting process. The State works with several advisory councils to determine how to handle some sources, such as fugitives and other nontraditional sources.

New York also does not focus on any particular types of sources. All sources are inventoried that are subject to the Agency's permitting process. All point sources requiring permits are included. Excluded from the New York inventory are area sources which do not require permits, boilers with a heat input of less than 10^6 Btu per hour, and certain small sources such as dry cleaners.

Maine selected 700 sources from three categories: (1) facilities with existing Agency emission licenses, (2) facilities that had submitted hazardous waste data to the Maine Bureau of Oil and Hazardous Materials, and (3) facilities picked from the Maine Marketing Guide which, because of their SIC codes and the number of their employees, were deemed likely to emit more than the inventory cutoff level. Maine established a 2000 lb/year emission level cutoff to eliminate small point sources of toxics from the inventory. This annual 2000 lb/year cutoff level was negotiated between industrial groups and the Maine Department of Environmental Protection. The inventory was designed to focus on four types of sources: (1) process, (2) incinerators, (3) storage facilities, and (4) loading, unloading transfer operations. It also included some nontraditional and area sources, such as schools, hospital, sewage treatment plants, bulk gasoline marketing, woodburning stoves, automobiles, open dumps, dry cleaners, and degreasers.

Minnesota currently limits its toxic pollutant inventory to only those sources included in its criteria pollutant emission inventory.

The California Air Resources Board is primarily responsible for mobile sources throughout the State, while the Air Quality Management Districts have the responsibility for inventorying stationary sources. Selections of the stationary sources to be inventoried are made from the Districts' knowledge of sources and from information in published EPA reports and other documents. All types of sources are inventoried, including area and nontraditional sources.

Hudson County, New Jersey inventories all but a few types of traditional sources. Retail food establishments, analytical laboratories, fuel burning facilities with indirect heat exchange which burn commercial fuels, and incinerator sources are exempted. The Agency does not have an emissions de minimis level.

Rhode Island selected a few sources from several Standard Industrial Classification (SIC) categories in an attempt to cover a wide range of source types. Large companies in each category were selected because of their greater likelihood of emitting toxic pollutants than smaller ones. SIC category selection was made from a review of air toxics literature and emission assessment documents. The Agency felt that to avoid missing any potential emitters in its initial inventory, it should select a small number of sources in each category. This first inventory was similar to a screening survey, which the Agency feels was useful and served its intended purpose. The next phase of the inventory will include fewer sources, with a focus on sources with high emissions potential.

The New Jersey Department of Environmental Management includes emissions data on air toxics in their criteria pollutant inventory. There is no separate inventory for toxics. Data are obtained through permit applications and source registration. These sources are required to provide data describing all pollutants emitted and separate emissions of particulate matter and VOC as they come up for review.

North Carolina plans primarily to inventory point sources included in its permitting system. Plans are to exclude from the inventory some area sources, such as dry cleaners. The North Carolina air toxics inventory will focus on the industries which are prevalent in the State. De minimis or cutoff levels have been developed that are a function of substance toxicity.

Sources to be included in the Iowa air toxics emission inventory were initialy selected from the existing criteria pollutant inventory. Smaller sources whose annual toxics emissions were less than 1 ton per year will be excluded from the inventory. Since the existing criteria pollutant emission inventory is somewhat out-of-date, the 1986 Iowa Manufacturers Register was also reviewed to identify sources which are not included in the Agency's criteria pollutant emission inventory or permitting system. Area sources are being included, as well as some nontraditional sources, such as landfills.

Idaho's Bureau of Air Quality coupled its air toxics inventory with its VOC emission inventory. Sources elected for the VOC inventory were also surveyed for emissions. A point source emissions cutoff level of 1 ton of toxics per year was used to help focus on the major sources of concern. Some nontraditional sources and area sources, such as mobile and residential wood burning, were also inventoried. Industries which are prominent in Idaho were emphasized.

Oregon reviewed work done by other States and reported in the literature to develop a list of SICs thought to be important with respect to air toxics.

This list was applied to the permitted facilities to determine whom should be sent industry specific questionnaires. Oregon noted that area sources such as pesticide use, slash and field burning and woodstoves are as significant as point sources. Oregon suggests caution when referring to older literature describing sources and expected emissions of air toxics. For example, during the literature search, the Agency identified printing as a source category of concern. After reviewing the completed questionnaire surveys from printing facilities, the Agency noted that ink formulations have changed significantly and that emissions of organic compounds may be less than orginally anticipated.

B.3 Geographical Areas

Most agencies developed their air toxic emission inventories either through their criteria pollutant inventory or their permitting systems. Consequently, the toxic inventories generally cover the same areas as the criteria pollutant emission inventories or permitting systems.

Massachusetts inventories the entire State through the source registration system. A hotspot for methylene chloride has recently been identified.

Puget Sound covers the entire region (King, Kitsap, Pierce, Snohomish Counties) and does not focus on any hotspots or urban areas.

Washington developed their air toxic emission inventory from their criteria pollutant emission inventory, which covers the entire State excluding the Puget Sound region.

New York currently inventories the entire State. However, the State contact believes that the initial phases of the inventory effort probably focused on hotspots and urban areas throughout the State.

In California, the local air pollution agencies, which perform the emission inventories, generally focus on highly populated areas where there is a concentration of sources. The districts also focus on some hotspots such as areas where there is a high concentration of gas stations (benzene concern) and hospitals (ethylene oxide concern).

North Carolina plans to inventory the entire State, rather than focus on particular areas, and does not plan to focus on hotspots.

Iowa plans to inventory the entire State. Nevertheless, more emphasis will be given to counties with greater populations because they have a higher health risk potential. The State does not plan to focus on any hotspots within urban areas where collections of point and/or area sources can cause particular problems.

Idaho inventoried the entire State from a desire to develop concurrent air toxics and VOC emission inventories. No special consideration was given to urban areas or hotspots.

B.4 Screening Studies

Before initiating the actual inventory effort, the California, Minnesota, Virginia, Iowa, Idaho, North Carolina, Pennsylvania, Oregon, Washington and San Francisco Bay Area agencies performed some type of screening surveys to help focus the toxic inventory effort.

California supports the use of screening surveys. The State collaborates with the State Department of Health Services, the EPA, and a nine member Scientific Review Panel to screen pollutants for inclusion in the air toxic inventory. Since the inventory effort for stationary sources is done by the individual districts rather than the State, the districts are responsible for screening sources of these pollutants in their area. For example, the Bay Area conducted a preliminary survey to identify which sources to focus its detailed, quantitative survey on. The State contact expressed that a single, targeted survey might be sufficient, but added that this is dependent on the Agency's knowledge of the area to be inventoried.

Minnesota and the Virginia State Air Pollution Control Board developed initial survey questionnaires which were used in a preliminary screening effort. Minnesota requested sources to identify which of 37 toxic substances were emitted by their facility while Virginia required sources to identify which of 66 noncriteria substances were emitted by their facilities. The agencies were thus able to better focus the inventory by knowing which pollutants are emitted by which sources and also which pollutants are more likely to be emitted.

The Iowa screening study is currently being performed to identify potential sources and toxics. The VOC Species Data Manual (Reference B-2) was used to help identify the types of toxics which may be emitted from various SCC categories. The Hazardous Constituents list of 40 CFR Part 261, Appendix VIII, is the base list of toxics to be inventoried. Several other substances common to sources without SCC numbers were also included. Sources to be inventoried were initially identified through the existing criteria pollutant inventory. The 1986 Iowa Manufacturers' Register was also examined to identify new sources not included in the criteria pollutant inventory. Although area sources were not included in the criteria pollutant inventory, several will be included in the toxic inventory. Some nontraditional sources, such as landfills, will also be included on the suggested toxic source list. Preliminary toxic emission estimates were made using the criteria pollutant source data and apportioning factors from the VOC Species Data Manual. Sources were then analyzed and ranked based on these calculated emissions and other source process information. Hence, both potential sources and toxics were evaluated for prevalence and priority within the State by a screening study.

A screening study was initially performed to help focus the Idaho air toxic emission inventory effort. The State later stopped the screening study, because it was considered to be too restrictive and would have made the inventory too small. In this particular case, the screening study, as designed, was not deemed to be helpful.

Washington performed a screening study in which potential sources and toxic substances were identified for inventory inclusion. The Washington contact felt that screening studies are helpful but are not necessary.

The Pennsylvania Bureau of Air Quality Control has recently begun an air toxics emission inventory for 38 substances. As a first step, a screening survey was used to help the State focus their inventory efforts. The screening survey was designed to collect basic, mainly nonquantitative data on the type of substances used, stored and/or emitted. Completed questionnaires were returned by about 90 percent of the 700 facilities to which questionnaires were sent. The Bureau of Air Quality Control attributed the large response to the planning that was done before the survey was sent out. For example, only larger facilities, selected from the existing criteria pollutant inventory, were sent questionnaires. It was felt by the Agency that larger facilities would be better able to respond to the questionnaire. As a second step, the data received during the screening survey is being validated by field personnel during regularly scheduled plant inspections. Validation by field personnel will be completed before the data are actually used. Information obtained during the screening survey will be used by the Agency to decide which sources or source categories require a follow-up and more detailed data collection effort. The Agency hopes to have this initial air toxics inventory completed by late 1986.

The Bay Area Air Quality Management District (BAAQMD) in San Francisco conducted a screening survey and material use survey prior to preparing an air toxics emission inventory. The screening survey was sent to all permitted sources in the Agency's jurisdiction. It requested that the source identify (by checking a box on the form) which of a list of 50 substances were used, bought or made at the facility. Ninety-five percent of the sources receiving the screening survey completed and returned the form. Personnel from the BAAQMD enforcement division called on sources to encourage them to respond to the survey. After the results of the screening survey were reviewed, an individualized material use survey was sent to appropriate sources. For example, if a source reported that it used benzene in the screening survey, then the material use survey requested quantitative data (throughput, amount used, etc.) Then, based on the results of the material use survey, the Agency estimated emissions for the 50 substances included in the survey. The BAAQMD recommends a screening survey prior to beginning an air toxics emission inventory. The results of the screening study provide a good starting point for developing a complete air toxics inventory.

North Carolina has completed a preliminary source category survey. The screening survey helped identify source categories (by SIC code) which warranted further, more detailed research. North Carolina's screening survey was based on an SIC-pollutant index. North Carolina recommends a screening approach and use of a SICpollutant index to other Agencies beginining an air toxics emission inventory.

B.5 Inventory Uses

The contacted agencies use air toxic emission inventories for different purposes. Emission inventory purposes vary from responding to public request for data to developing regulations and investigating certain environmental problems.

Nevada-Clark County uses its air toxic emission inventory to evaluate certain environmental problems. The Agency believes hydrogen chloride emissions cause impairment to visibility in Clark County. The major hydrogen chloride emission sources were identified through the inventory. The inventory is also used to evaluate alternative control strategies, to inform the public about toxic pollution emissions, and to respond to public requests for information. The Agency informs the public periodically about various environmental issues such as the county's visibility problem.

The Puget Sound inventory has been used to develop a waste oil inspection strategy, to respond to public requests for toxic substance emission data, and to occasionally assess health impacts. The Agency was able to eliminate, through the use of the toxics inventory, establishing an unnecessary ambient standard for arsenic.

The Texas air toxic emission inventory is used to plan on-site inspections and conduct health effects evaluations. The inventory is also used to summarize and distribute source data to State›regional Agencies. This aids in the statewide enforcement program and in the correction of environmental problems. The emission inventory is also used to evaluate alternative control strategies.

New York utilizes the air toxic emission inventory for SIP planning and for ambient monitoring planning. For example, the inventory was used for identifying the major emissions sources of benzene. Having identified these major sources, the Agency was able to plan an appropriate monitoring network through the use of atmospheric dispersion modeling. It was then possible to determine local environmental impacts of the benzene emissions. Inventories are also used for evaluating alternative control strategies.

In Washington, regulations are being developed based on information from the toxic emission inventory. Inventory information is also being used to supply community right-to-know information. Although the inventory has not yet been used for emergency responses, Washington has identifeid emergency preparedness as a possible use. Finally, by reviewing the inventory data, the State is better able to focus its subsequent inventory efforts.

The Massachusetts Stationary Source Emissions Information System (SSEIS) has been used for several purposes within the State. The State Health Department has used the system for epidemiology studies, such as liver cancer studies. The system can provide information on a particular source, area, or chemical which can help identify potential cancer risks. The SSEIS is also used for public requests for data. Presently, the system has not yet been used for risk assessment or for providing emergency response information, although it can be used for these purposes. Once some computer operational problems are resolved, the system may be utilized by individual regions to assist in emergency response programs.

Maine indicated the initial purpose of its air toxic emission inventory was to satisfy a legislative mandate.

Minnesota primarily uses its emission inventory to identify what toxics are emitted in the State. The inventory was also used to prioritize the sources in terms of the magnitude of toxic emissions. Minnesota does not plan to do any risk assessment modeling.

California uses its air toxic emisison inventory primarily to help develop its toxic air contaminant control strategy. The inventory helps target affected sources for control measures. It also is used to determine if a chemical should be identified as a toxic air contaminant. Once a chemical is identified as a toxic air contaminant, steps must be taken by the air quality control districts to mitigate the health impacts associated with air emissions of the substance.

Hudson County, New Jersey intends to use the air toxic emission inventory as a tool to identify local areas having particulary high concentrations of air toxics. The inventory is also expected to be used for some simple risk assessment modeling.

Rhode Island prepared their emissions inventory to support an air toxics regulation. The inventory was used to select the air toxics to be covered by the regulations.

The Idaho air toxic emission inventory was conducted primarily to determine the severity of the air toxics problem in the State. The Agency wanted to know what types of toxics were being emitted and what are the major emission sources.

B.5 Use of Criteria Pollutant Inventories

The Massachusetts, Washington, Puget Sound, California, Minnesota, Iowa, Idaho, Rhode Island, Virginia, and Texas Agencies used existing criteria pollutant inventories as a starting point and/or basis for developing the air toxic emission inventory. The criteria pollutant inventories were used primarily to identify potential air toxic sources and to help verify toxics emission data provided by the sources such as stack parameters and production rates. Iowa used its VOC emission inventory to estimate air toxic emissions. The South Coast Air Quality District used its VOC emission inventory to estimate benzene emissions from combustion processes.

Not all Agencies relied on the criteria pollutant emission inventory as a starting point or basis for developing the air toxic emission inventory. In New York and Nevada-Clark County, all sources and pollutants were determined through each Agency's permitting process. Maine developed its air toxic inventory from "scratch", but did use its emission licensing system to select sources for the inventory. The North Carolina criteria pollutant inventory is considered to be outdated and would not be useful in an air toxics emission inventory program.

B.6 Questionnaires

Texas, Maine, Minnesota, California, New Jersey-Hudson County, Pennsylvania, Oregon, Rhode Island, San Francisco Bay Area and North Carolina have developed questionnaires specific for toxic emission data collection. Each of these State's questionnaires is discussed in the following paragraphs. The other States collected their toxics emission data through their permit and/or registration process.

The Texas air toxics questionnaires are similar to the criteria pollutant questionnaires. Basically the same type of information is requested for toxic pollutants that is requested for criteria pollutants, i.e., emission rates, stack parameters, etc. The primary difference is that the toxic VOC constituents must be identified.

Maine developed air toxic questionnaires similar to the criteria pollutant questionnaires. The toxic questionnaires, however, were not as comprehensive as the criteria pollutant questionnaires in that they requested only the total use of a substance and the total plant-wide emissions. Criteria pollutant questionnaires request that emissions be listed by process operation. The toxics questionnaires were designed to obtain information from four categories of sources, including manufacturing processes, incinerators, storage facilities, and loading/unloading/transfer operations.

Minnesota has used two types of questionnaires in its inventory efforts. A qualitative toxic air pollutant survey form was initially distributed along with its criteria pollutant emission inventory questionnaire. The survey was a one page form listing the State's 42 identified air toxics. Sources were asked to indicate which compounds were used at their facility. The qualitative survey form was later followed by a quantitative questionnaire to gather more specific information on the use of toxics, such as operating schedules, quantities handled and emitted, stack or vent parameters, and control equipment. Sources were also requested to identify other substances being used which may be considered toxic.

California tailors air toxic questionnaires for specifc substances for which data are lacking. The agency also works with technical advisory committees to develop general questionnaires for use by the regional agencies. These questionnaires may differ signficantly from the criteria pollutant questionnaires.

Hudson County, New Jersey also developed a questionnaire specific for toxics. Basically the same type of information that is normally needed for a criteria pollutant inventory -- such as stack parameters, emission rates, etc. -- was requested on the toxics questionnaire.

Rhode Island has developed a questionnaire specific for air toxics. The basic format of the questionnaire is general for all industries.

North Carolina has recently distributed data collection forms to 325 facilities based on the results of the screening study. Data were requested from these facilities to assist the State in beginning their detailed air toxics emission inventory. A mandatory "registration" process is used. The data collection forms were designed to help provide data for dispersion modeling work planned for the near future and in development of an economic impact analysis of the State's planned air toxics program.

North Carolina recommended that other agencies may benefit from limiting questionnaires or surveys to include only data that are absolutely necessary, and to keep in mind the ability of the source to respond to the questionaire. North Carolina also felt that a targeted approach and a manageable list of pollutants of concern have been keys to their success thus far.

One unique aspect of the North Carolina survey questionnaire is the method of screening low-quantity emitters of toxics. The Agency prepared a list of emission rates below which a source is not required to report actual emissions. These de minimis levels were determined by a screening model predicting conservative ambient concentrations. North Carolina feels that having a cutoff point will help sources by decreasing reporting requirements, and reduce Agency time spent on trace emissions.

Finally, North Carolina has developed a staggered approach in distributing their survey questionnaires. About 300-400 questionnaires will be sent out every 60 days, to a mix of major and minor sources. The timing of the mail out will allow a better opportunity to manage the incoming data and respond to inquiries. The mix of source sizes will allow for providing assistance to individual sources. Minor sources are expected to require the most assistance. Also, the mail out was designed to distribute the work load equally between the State's seven regional offices. Therefore, one regional office would not be inundated with requests for assistance from sources.

Industry-specific questionnaires were developed for Idaho's air toxic sources. For example, the paint industry was requested to supply information on the types and quantities of paints, thinners and solvents used. In some cases, the questionnaires were source-specific, e.g., a questionnaire was used to request emission data from storage tanks. The air toxic questionnaires were coupled with the criteria pollutant questionnaires, thus the information requested was the same except that sources were to identify the toxic constituents of their VOC and particulate emissions.

Oregon also developed industry-specific questionnaires for surface coating, storage tanks, waste oil combustion, pesticide manufacturing and other manufacturing processes.

B.7 Other Data Collection Procedures

Several agencies used other data collection procedures besides questionnaires, as described in the following discussion.

Nevada-Clark County uses its permitting process as its major data collection method. Most data is gathered through the investigation of permit/compliance information. Plant inspections are performed on new sources to verify data submitted for obtaining a construction/operating permit.

New York relies mainly on information supplied with permit applications to satisfy toxic emission data needs. Facilities are also visited as a recertification procedure.

Massachusetts uses its registration forms to obtain toxic emissions data. Plant visits are performed by the State's regional inspectors to verify data. Right-to-know information was found to be of limited usefulness as an air toxics data gathering tool due to industry-imposed security and confidentiality requirements.

Washington and Puget Sound gather toxics emission data through a coupled criteria pollutant/air toxic registration form. The State's local air pollution control agencies are able to verify all source information through annual plant inspections. Puget Sound requested OSHA Material Safety Data Sheets from sources to identify the toxic components of the materials each source utilizes. The Material Safety Data Sheets provided information which the sources may not otherwise have been able to supply. The actual chemical compounds comprising the materials used by each source are identified on these data sheets as well as the material's physical data, such as boiling point, solubility, evaporation rate, flash point, and fire and health hazards.

In addition to questionnaires, Texas also reviews permit/compliance information to collect data. When dispersion modeling is needed, the agency requests more specific information, such as topography maps. State regional personnel may perform routine surveillance investigations as a means to verify source data. Data may also be validated by comparison with an existing, similar facility or by conducting an engineering analysis of the process.

As an alternative data collection method, Maine agency personnel occasionally visited certain sources such as printers or degreasers to become familiar with the type of processes at those potential sources. All sources which had not responded to the questionnaire were contacted individually by telephone and were reminded of the inventory and its importance.

Minnesota plans to update the air toxics emission inventory through its operating permit system. A public right-to-know program has not been adopted in Minnesota. Registry data and Material Safety Data Sheets were not useful in collecting air toxics emission data.

California used information from district offices and data from criteria pollutant inventories to supplement information provided by toxics questionnaires. Plant visits were also made and source compliance/permit data were sometimes used as an alternate means of data collection. Material Safety Data Sheets were not utilized; however, suppliers were contacted to obtain the data that these sheets provide. The California contact stated that supplying complicated source parameter data and decoding trade name chemicals are burdensome for smaller sources.

Material Safety Data Sheets were used by Hudson County, New Jersey to identify the makeup of a company's emissions when the company claimed it did not know the makeup. Specific quality assurance measures in the county entail source visits by agency personnel to verify submitted source data.

Rhode Island sent follow-up letters to sources located in hotspots to obtain data not provided on the questionnaires. In a few cases, actual source inspections and meetings were held to clarify quantities and types of emissions. Hazardous waste manifest data was also reviewed to help gather data. Material Safety Data Sheets were used extensively to clarify brand name and trade name constituents. The State's right-to-know information was not accessible.

Idaho telephoned sources to request information not provided on their questionnaire. The importance of the air toxic inventory and the need for data was stressed. Permit/compliance information was occasionally used to supply missing data. The State's inventory was small enough, however, and the State was familiar enough with the sources that in most cases, the State was able to provide the missing data. Registry data, Material Safety Data Sheets and right-to-know information were not used.

B.8 Data Quality

Most agencies reported that sources had little difficulty supplying the required information.

In New York, facilities are required to supply all the requested information in order to receive an operating permit. The need for a permit to operate provides sources the incentive to give pertinent data. The Agency offers confidentiality when possible for trade names and process descriptions. All data are reviewed by agency engineers and if the data or emission estimates do not appear reasonable, sources may be required to verify them with source test results.

Massachusetts sources reportedly had no major difficulty supplying requested toxic emission information. Data elements common to toxic and criteria pollutants were compared with several years of previous data. If the data agreed with previous submitted information within 10%, they were accepted as accurate. Chemical nomenclature posed no major problems. Confidentiality and security were the only inhibiting factors in the data collection procedures. Sources were assigned confidentiality codes so that data are only accessible if the appropriate codes are used.

New Jersey stressed checking the quality of the data prior to entering it into a data management system. New Jersey suggested that agencies just beginning an inventory may benefit from a county-by-county approach at first, instead of attempting to cover an entire State.

Most Puget Sound sources had no difficulty supplying the agency-requested data. OSHA Material Safety Data Sheets were requested for the air toxics inventoried, thereby eliminating any brand name component identification difficulties. Nomenclature did not create any problems. Initially, some sources were unable to supply enough information to quantify the toxic emissions. The Agency requested those sources to supply whatever information they had about their processes, materials and emissions. The Agency was able to estimate the emissions for these sources from information obtained from similar sources. All individual source information is summarized annually on a computer printout that the registrant must update and correct.

The Nevada-Clark County agency indicated that most sources experienced little difficulty in supplying necessary traditional source information. In some cases, however, where emission estimation methods were not practical, or where sources were unable to supply data, the agency made estimates based on pollutant parameters, process procedures and engineering principles. For example, some large industries did not know how to estimate the emissions from cooling towers. The agency estimated these emissions by conducting an engineering analysis using available data and process knowledge.

Texas indicated that sources were able to supply the necessary information. Nomenclature and brand names were not a problem. Texas validated emission rates for particular sources by comparing the rates to an existing, similar facility or by conducting an engineering analyses of the process.

Washington also indicated that sources has no problem supplying necessary information, however, the validity of this data is questioned. The Washington contact felt that sources really do not know the type of toxics they emit nor the quantities they emit. Washington did not supply a cross reference list of alternative chemical names or trade names, but major nonmenclature problems did not occur. The State performed all emission calculations, so the sources were not required to give estimates.

Maine reviewed all questionnaires to verify the data submitted. Based on this evaluation, several facilities from three categories of sources were selected for on-site follow-up visits as a second tier quality assurance measure. Source categories selected for the follow-up procedures were sources that reported significant emissions, sources which responded and reported no emissions, and sources which did not respond at all. Maine utilized Material Safety Data Sheets which eliminated some substance identification difficulties. In some cases, however, Material Safety Data Sheets were inadequate, therefore, brand name substances were occasionally difficult to identify.

Minnesota reported that the gathered toxics information undoubtedly contained some inaccuracies. Skepticism was expressed about the ability of some small sources to accurately estimate their toxic emissions. Confidentiality caused problems for some sources in Minnesota. Brand names created many difficulties, because sources did not know the chemical constituents of the materials. Minnesota also indicated that a major data collection difficulty was its lack of a person experienced in dealing with chemical processes and emissions who could make value judgments on processes and emissions.

California indicated that not all sources were capable of supplying the needed information. Some smaller sources had problems supplying some data such as stack parameters. Also, some sources were reluctant to supply confidential data. The use of brand names also hampered the data collection effort. The State helped in decoding brand names.

Hudson County, New Jersey had no confidentiality problems associated with collecting data and toxic pollutants. In most cases sources were able to supply the needed information. Brand or trade name constituents were considered to be easily identified.

Rhode Island satisfied confidentiality concerns by storing confidential data in locked files. Constituent identification of some brand name materials occasionally caused difficulties.

B.8 Computerization of Inventory Data

Most agencies use a computerized data handling system which is coupled to their criteria pollutant system. Several agencies incorporate a file of air toxic emission factors into their system to automatically calculate emissions, while other agencies either manually calculate emissions or rely on source estimates which are entered into the data base.

The Nevada-Clark County agency utilizes a computerized data base. Emissions are manually calculated either by the agency or by the source and entered manually into the system.

Puget Sound couples all toxic source data with the criteria pollutant source data in a computerized system. A file of air toxic emission factors is incorporated into the system to automatically calculate air toxic emissions. Where emission factors are not available, they are developed from the source's data.

Texas uses a computerized data base that includes both the criteria pollutant and air toxic emission inventories. Sources supply emission estimates which are directly entered into the data base, hence, the computer does not actually calculate the emissions. An in-house quality assurance check is performed by agency engineers before the data are entered into the system. Engineers review the data to assess their reasonableness and accuracy.

The New York air toxic inventory includes about 300 substances, so a computerized system is a necessity. The data base includes both criteria and toxic pollutants, but the system does not calculate pollutant emissions. Sources supply emission estimates, and the State's engineers review the data before entering them into the system. Pollutant emission data are stored and retrieved by an appropriate Chemical Abstract Services (CAS) number and a corresponding National Emissions Data System (NEDS) number.

The Washington emissions data handling system is computerized and contains both the air toxics and criteria pollutant data. The system incorporates a file of emission factors which automatically calculates air toxic emissions for a limited number of point sources. An area source file is kept separate from the point source file. The Agency manually calculates these emissions and enters them into the data base. The Washington data handling system is in the development stages.

In Massachuetts, air toxic data handling is coupled with criteria pollutant handling in a single system. The system (SSEIS) incorporates a file of emission factors to automatically calculate emissions. These emission factors were developed for estimating total VOC emissions, but can be used to estimate the emissions of the VOC constituents. The composition of the VOC-generating material must be known to use the factors for this purpose. When no emission factors are available, emissions are manually calculated using a mass balance approach. These estimates are then entered into the data base. The Massachusetts data handling system is currently being evaluated by EPA as a prototype for a national data handling system. The system includes provisions for handling air toxics.

In order to deal with the volume of data reported, Maine developed an on-line computerized data handling system. This system utilized the Department's Honeywell Level 6 mini-computer. Some problems were experienced in fitting their data base onto the data handling system.

Minnesota's air toxic emission inventory is currently handled manually. Plans are to integrate the data into the criteria pollutant emission iventory in the near future. This will facilitate the summatio of the survey data for reporting purposes. Computerization of the survey data will also make it easier to update the air toxics inventory, which will be done through the agency's permit process.

California has developed a prototype computerized data handling system. The system requires some revisions and is not yet operable. The air toxic system will be separate from the criteria pollutant system.

The Hudson County, New Jersey data handling system allows the agency to store toxics emission data but has very limited reporting and data analysis capabilities. The system is installed on a personal computer.

Rhode Island utilizes a computerized data handling system. The system is entered on IBM PC software and uses dBase III. Data are entered by toxic pollutant source, and may then be sorted and reported in various ways by the dBase III program.

The Idaho data handling system is computerized. It does not incorporate a file of air toxic emission factors to automatically calculate emissions. Emissions must be manually calculated and entered into the data base. The air toxic system is separate from the criteria pollutant system; however, it has unique interactive capabilities with EPA's Emission Inventory System (EIS/PS.)

North Carolina and Virginia are currently planning data handling systems.

B.9 Emission Estimation Methods

Most agencies request each source to supply air toxic emission estimates. Others feel sources are not realistically capable of supplying accurate estimates. Those agencies which do some emission calculations primarily use either emission factors or material balances. The specific approaches used by the various agencies for estimating emission rates are described in the following paragraphs.

New York requires sources to supply emission estimates. Permit applications have specific codes which sources must use must use to indicate whether the emissions were estimated by material balance, emission factors, source tests, or other methods. Sources are required to supply information to substantiate emission estimates with their permit applications.

Nevada-Clark County determines toxic emissions from the source's permit application. Sources supply all pertinent information and test results as part of the application. When emission data are not provided, the agency estimates emissions using process data and engineering principles. Emission factors are used when available.

Puget Sound also requires sources to supply emission estimates. Most estimates entered into the data handling system, however, are actually generated by the system using emission factors. When emission factors are not available, they are developed from source estimates and other source information and entered into the computer to calculate emissions.

Texas sources supply air toxic emission estimates using material balances, emission factors, and source tests. In some cases where traditional emission estimation methods are not practical, such as for waste water treatment plants, other techniques must be used. The agency relies on American Petroleum Institute literature, physical property data, and an advisory council to help estimate emissions from nontraditional sources such as these.

Massachusetts requires sources to supply emission estimates whenever they can which are entered into the data handling system. Otherwise, emissions are system-calculated using NEDS emission factors. These emission factors were developed for estimating total VOC emissions but may be used to estimate emissions of VOC constituents. The composition of the material generating the VOC emissions must be known to use the factors to estimate the VOC constituent emissions. When no emission factors are available for a certain process or operation, emissions are manually calculated using a mass balance approach. These estimates are then entered into the computerized data system.

Maine requested sources to supply plant-wide emission estimates, but, not all sources provided this information. When emission estimates were not provided, the State determined them through discussions with plant operators, comparisions of the source with similar industrial sources, and analyses of the chemicals used at the facility. The most commonly employed emission estimation techniques, however, were emission factors and material balances.

Minnesota required that the sources estimate their air toxic emissions. The agency has no experience with special air toxic emission factors.

California estimates toxic emissions primarily from source test results, material balances, and emission factors. Where these methods are not practical, other methods are used. In some cases, estimates provided by the source are accepted if the methodology is considered valid.

Hudson County, New Jersey requires sources to estimate the emissions of specific toxics. Agency engineers review the submitted estimates to verify their validity. Occasionally, sources reply that they are incapable of estimating emissions. In these instances, the county attempts to estimate the emissions. In cases of enforcement action and non-compliance situations, Hudson County performs an in depth analysis. Actual stack testing may be required to verify source emission estimates.

Rhode Island primarily estimated toxic emissions by material balance calculations or by using general emission factors. No special emission factors were developed. The State has no specific techniques for estimating fugitive emissions. The material balance approach is expected to account for fugitives.

Virginia requires sources to supply emission estimates. Estimates are based on various methods including emission factors, material balances, and emission test results.

Emissions for the Idaho air toxic emission inventory were manually calculated using many methods. Emission factors were the primary means. Material balances were also performed for some sources. Actual source test results were also employed when available. No special emission calculation techniques were used for air toxics.

B.10 Useful Agency Reports

Few agencies have produced any formal documents related to air toxic emission inventories. Maine (Reference B-4), Idaho (Reference B-5), Puget Sound (Reference B-6), Minnesota (Reference B-7), North Carolina (Reference B-8), New York (Reference B-9), Massachusetts (Reference B-10), and California (Reference B-11) have published reports on various aspects of their toxics inventory efforts.

B.11 Useful Data Handling Systems

Only a few agencies indicated that their data handling systems have any particularly useful features or capabilities. One helpful feature of the Puget Sound data handling system is the ability to summarize all the source data on a single computer printout. The printout can then be sent to each source for additions and corrections.

The New York data handling system has a technique to summarize expiring permits. As source permits expire, the system automatically generates a listing of those sources. These listings are sent to the appropriate regions which are chartered to initiate the permit recertification process. The end result is improved communication between the State headquarters and the field office.

Massachusetts has perhaps the most refined data handling system. It is currently being presented to the EPA as a prototype for a national data handling system. The system is to be used nationally for criteria pollutants with provisions for air toxics. Massachuesetts also has separate data bases for the State's right-to-know program and for the State's source hazardous waste identification program. The SSEIS data handling system is interactive with these two data bases.

The New Jersey DEP uses a six digit numerical system, based on the Merck Index, as a basis for identifying pollutants in their inventory, along with each chemical's Chemical Abstracts Service (CAS) number and chemical name. The inventory data base can be searched by pollutant code number for pollutant emissions, raw material use, control equipment, and Source Category Classification (SCC) code.

REFERENCES FOR APPENDIX B

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B-3. Volatile Organic Compound (VOC) Species Data Manual, Second Edition, U. S. Environmental Protection Agency, Research Triangle Park, NC, July 1980.

B-4. Hazardous Air Pollutants in Maine: Emissions Inventory and Ranking System. Maine Bureau of Air Quality Control, Division of Technical Services and Maine Bureau of Health, Environmental Health Unit, Environmental Toxicology Program. March 1985.

B-5. Air Toxics and Volatile Organic Compound Emission Inventory and Program Development for the State of Idaho. Engineering-Science, Inc., Boise, ID, 1985.

B-6. Air Toxic Emissions from Selected Non-traditional Sources in the Puget Sound Region. Engineering-Science, Inc., Boise, ID, September 1985.

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B-8. North Carolina Air Toxics Survey - Identification of Pollutants of Concern and Potential Emission Sources. Radian Corporation.

B-9. New York State Air Guide 1, Guidelines for the Control of Toxic Ambient Air Contaminants. New York State Department of Environmental Conservation, Division of Air Resources. 1985-1986 Edition.

B-10. Massachusetts Stationary Source Emissions Information System (SSEIS) Training Manual. TRC Environmental Consultants, Inc., East Hartford, CT, May 29, 1984.

B-11. State of California Air Resources Board, Status Report Regarding the Toxic Air Contaminant Program. California Air Resources Board, January 1985.

TABLE B

ISSUE QUESTIONS USED TO GUIDE DISCUSSIONS WITH AGENCIES

PLANNING

1. How did your agency decide on what pollutants to cover?
    - Use arbitrary list?
    - Open-ended approach?
    - Tailored list (chosen by some screening criteria)?
    - Recommendations?
2. Does your agency focus on any particular types of sources? Why?
    - Point sources?
    - Area Sources?
    - Major/minor distinction?
    - Any sources excluded? Why?
    - Any emphasis on specific industries?
    - Recommendations?
3. How did your agency decide on what geographical area(s) to cover?
    - Arbitrarily cover entire State? Urban areas?
    - Based of ambient monitoring data? Health effects data?
    - Community input?
    - Any focus on smaller "hotspots" within urban areas where a collection of point and/or area sources is causing a particular problem?
    - Recommendations?
4. Were any screening studies used to help focus the inventory?
    - What kinds of screenings were done?
    - Are screening studies useful? Necessary?
    - How much effort should be devoted to screening?
    - Recommendations? Useful data sources?
    - Guidance needed?

TABLE B (CTD.)

PLANNING (cont.)

5. How is the air toxics inventory being used by your agency?

   - Modeling around individual point sources?

   - Areawide modeling of point and area sources?

   - To evaluate alternative control strategies?

   - Respond to public requests for data?

   - Emergency response information?

   - Other?

   - Does your inventory adequately accommodate all desired uses?

   - Recommendations?

DATA COLLECTON

1. Before initiating the data collection effort, does your agency screen sources to identify potential emitters of specific compounds, in order to focus the data collection effort?

   - Based on information in EPA or other reports? Which ones?

   - Has your agency developed some sort of source/pollutant "crosswalk", linking pollutants with probable emitters (e.g., on an SIC or SCC basis)? If so, is this available?

   - Is this a useful step?

   - Recommendations?

2. Is your agency able to use the existing criteria pollutant inventory as a starting point and basis for devleoping the air toxics inventory?

   - For locating potential air toxics sources?

   - For directly estimating air toxics emissions by applying air toxics emission factors to existing source data?

   - Other?

   - In general, would you recommend basing the air toxics inventory on the existing criteria pollutant inventory or recommended starting from scratch?

DATA COLLECTION (cont.)

3. Has your agency developed questionnaires specific for air toxics?

   - General or industry specific?

   - Are they substantially differenct from your criteria pollutant questionnaires? How?

   - Do you recommend coupling the air toxics questionnaires with the criteria pollutant questionnaires?

   - Recommendations?

   - Are any questionnaires available that were developed by your agency?

4. What other data collection procedures are used besides questionnaires?

   - Plant calls/visits?

   - Followup questionnaires?

   - Use of registry data, material safety data sheets, "right-to-know" information, etc.?

   - Use of permit/compliance information?

   - Recommendations?

5. Are sources capable of supplying the air toxics data your agency requires?

   - Source parameters?

   - Substance use data? (i.e., can sources specify how much of each substance is purchased, processed, produced, disposal of, etc.?)

   - Air toxics emissions estimates?

   - Does the use of alternative chemical names and trade names prevent proper reporting by sources and interpretation of responses by your agency? In this regard, does your agency distribute and/or employ some sort of list that cross references chemical names with althernative chemical names or trade names? Is this needed?

   - Recommendations?

TABLE B (CTD.)

DATA STORAGE, ANALYSIS AND REPORTING

1. Does your agency use a computerized system for air toxics?
    - Is it coupled with the criteria pollutant system?
    - Does it incorporate a file of air toxics emission factors to automatically calculate air toxics emissions.
    - Is a computerized system necessary for your purposes?
    - Recommendations?
2. How are air toxics emissions estimated?
    - Are sources required to supply emission estimates? Can they, realistically?
    - Agency calculates emissions from questionnaires or other data?
    - What estimating approaches are used?
        - Material balances?
        - Emission factors?
        - Source tests?
    - Are there any special emission calculation techniques used for air toxics?
    - Recommendations?
3. Does your agency produce any special reports from the inventory that are particularly useful in your air toxics program?
    - Recommendations?
4. Does your agency's data handling system have any particularly useful features or capabilities that you would recommend?
    - Interactive capabilities?
    - Organization/data hierarchy?
    - Others

APPENDIX C

SIC/POLLUTANT INDEX

APPENDIX C
SIC/POLLUTANT INDEX

This appendix contains an index matching source category, by Standard Industrial Classification (SIC) code, with pollutants known or reasonably anticipated to be associated with each SIC code. The associations may not be positive in all cases. Also, these data do not have any bearing on the quantity of pollutant emitted. Pollutants may be emitted in trace amounts or in the tons per year range.

The pollutants included in the SIC/pollutant index and pollutant/SIC index (Appendix D) were selected from lists of pollutants either currently regulated or under review by 25 State and local agencies or EPA. The lists were obtained from the National Air Toxics Information Clearinghouse (NATICH) and air toxics studies performed for various State agencies.

Several types of data sources were consulted to determine pollutants that may be associated with various SIC codes. General references describing production and use of chemicals provided information on use, and therefore, potential emissions of substances for which more detailed assessments are not yet available. The NATICH report data on permitting were also used to identify chemicals emitted from specific SIC codes. In addition to the hard copy report, the NATICH computer data base section on permitting was searched for pollutants permitted by State/local agencies and the source's SIC code. Air toxics inventories, screening studies, and air toxics program development studies conducted by and for State and local agencies were used to obtain any previously developed SIC/pollutant lists. EPA source assessments and emission factor development documents comprise most of the primary literature cited in the previously prepared inventory reports.

TABLE C-1. SOURCE CATEGORIES BY SIC CODE AND ASSOCIATED POTENTIAL POLLUTANTS

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
0189	---	hydrogen sulfide	13
0282	---	toluene	13
0289	---	ammonia, benzene, carbon tetrachloride, 1,4-dichlorobenzene, formaldehyde, hydrogen chloride, methyl chloroform, methylene chloride, chlorobenzene, PCB, phenol, styrene, perchloroethylene, toluene, trichloroethylene, Freon 113, vinylidene chloride, ethylene dichloride	13
0291	---	lead	13
0299	---	naphthalene	13
0373	---	toluene	13
0723	---	ethylene dibromide, hydrogen sulfide, hydrogen chloride, chlorine, ammonia	5, 12, 13
0724	---	arsenic, ammonia, hydrogen chloride	1, 5, 13
0754	---	asbestos	13
0851	---	naphthalene	13
1021	---	arsenic, mercury, cadmium, copper	1, 10
1031	---	arsenic, cadmium, mercury, lead, zinc, ammonia	1, 10, 13
1041	---	benzene	1
1061	---	nickel	1
1081	---	arsenic, toluene diisocyanate	1
1092	---	mercury	3

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[a] Applicable Source Category Classification (SCC) codes, where data were found, are listed along with the SIC code.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
1094	---	radionuclides, ammonia, gasoline vapors, hydrogen chloride, hydrogen sulfide	4, 13
1099	---	beryllium, arsenic, hydrogen chloride	1, 13
1111	---	arsenic, POM, PAH	5
1112	---	arsenic, toluene diisocyanate	1
1211	---	hydrogen sulfide	13
1213	---	arsenic, toluene diisocyanate	1
1216	---	perchloroethylene	13
1311	---	ammonia, formaldehyde, gasoline vapors, hydrogen chloride, hydrogen sulfide	13
1321	---	ammonia, hydrogen chloride, hydrogen sulfide	13
1380	---	gasoline vapors	13
1381	---	hydrogen sulfide	13
1382	---	benzene, carbon tetrachloride, 1,4-dichlorobenzene, ethylene dichloride, hydrogen sulfide, methyl chloroform, chlorobenzene, toluene, xylene	13
1389	---	hydrogen chloride, hydrogen sulfide	13
1422	---	nickel	1
1442	---	vinyl chloride	13
1446	---	beryllium, lead, arsenic, toluene diisocyanate, phenol	1, 13
1453	---	arsenic, toluene diisocyanate, beryllium, lead	1

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
1475	---	radionuclides	5
1477	---	arsenic, hydrogen sulfide	1, 13
1481	---	arsenic, toluene diisocyanate	1
1499	---	arsenic, beryllium, chromium, lead, cadmium, asbestos	1, 5
1501	---	gasoline vapors	13
1612	---	PAH, benzo(a)pyrene	5
1616	---	toluene	13
1629	---	arsenic, toluene diisocyanate, xylene, beryllium, toluene	1, 6, 13
1711	---	lead, arsenic, styrene	1, 13
1721	---	lead, arsenic, benzene, toluene, trichloroethylene	1, 13
1741	---	lead	1
1742	---	toluene diisocyanate	1
1743	---	styrene	13
1761	---	lead, copper	1, 10
1781	---	benzene, methyl chloroform, toluene, trichloroethylene, xylene	13
1791	---	toluene, gasoline vapors	13
1799	---	lead, arsenic, benzene, toluene diisocyanate, gasoline vapors, hydrogen sulfide, toluene	1, 10, 13
1950	---	ammonia, hydrogen chloride, methyl chloroform, toluene, trichloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
1951	---	ammonia, methyl chloroform, zinc oxide, trichloroethylene	13
2000	---	perchloroethylene, toluene	13
2011	---	formaldehyde, arsenic, hydrogen chloride, methyl bromide	1, 13
2013	---	arsenic, acetaldehyde, ammonia, chloroform, formaldehyde, methyl chloroform, phenol, toluene	1, 13
2023	---	benzene, toluene, formaldehyde, ammonia	1, 13
2032	---	benzene, toluene, formaldehyde	1
2033	---	arsenic, toluene	1, 13
2036	---	ammonia	13
2046	---	chlorine/HCl	10
2048	---	acrolein, methyl bromide	5, 13
2051	---	benzene, toluene, formaldehyde	1
2052	---	toluene	13
2063	---	beryllium	13
2065	---	benzene, toluene, formaldehyde	1
2070	---	methylene chloride, ethylene dichloride	5, 3
2075	---	ethylene dichloride	5, 1
2079	---	nickel, toluene	4, 13
2080	---	ammonia, formaldehyde	13
2086	---	arsenic, toluene	1, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2091	---	arsenic, hydrogen sulfide	1, 5
2095	---	acetaldehyde, acrolein, methylene chloride, trichloroethylene	1, 7, 13
2097	---	arsenic	1
2099	---	acetaldehyde, benzene, benzidene, carbon tetrachloride, chloroform, dimethyl sulfate, epichlorohydrin, ethylene oxide, formaldehyde, maleic anhydride, methyl isocyanate, phenol, methylene chloride, nitrobenzene, xylene	13
2111	---	benzene, chloroform, formaldehyde, methyl chloroform, methylene chloride, perchloroethylene, toluene	5
2141	---	benzene	1
2190	---	toluene	13
22[b]	---	trichloroethylene, bis(chloromethyl) ether, phenol	1 1, 4, 5
2211	---	1,4-dioxane, acrylonitrile, benzene, ethylene dichloride, toluene	1, 5, 13
2216	---	perchloroethylene	13
2221	---	acrylonitrile, toluene diisocyanate, 1,4-dioxane, ethylene dichloride, benzene, perchloroethylene, styrene, chloroform, mineral fibers, formaldehyde	1, 5, 10, 13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2231	---	1,4-dioxane, benzene, formaldehyde, perchloroethylene	1, 13
2241	---	1,4-dioxane, benzene, mineral fibers	1, 10
2250	---	benzidine, benzene	5, 4
2252	---	benzene, acrylonitrile	1, 5
2253	---	benzene, arsenic, perchloroethylene, ammonia	5, 13
2261	---	1,4-dichlorobenzene, benzene, acrylonitrile, chromium, toluene	5, 13
2262	---	xylene, hydrazine, copper, benzene, 1,4-dioxane, perchloroethylene, formaldehyde	5, 1, 10, 13
2269	---	vinyl chloride, vinylidene chloride, hydrazine, benzene, benzidene, toluene, xylene, formaldehyde, 1,3-butadiene, acrylonitrile, perchloroethylene	5, 1, 4, 13
2271	---	arsenic	1
2272	---	formaldehyde, benzene	5
2279	---	arsenic	1
2281	---	toluene diisocyanate	1
2282	---	lead, toluene diisocyanate, ammonia	1, 12
2283	---	arsenic	1
2291	---	arsenic, methyl chloroform	1, 13
2293	---	benzene	5
2294	---	formaldehyde	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2295	---	perchloroethylene, vinylidene chloride, xylene, lead, arsenic, benzene, cresol, hydrogen chloride, formaldehyde, styrene, toluene	1, 13
2296	---	asbestos, benzene, toluene, ammonia, perchloroethylene, formaldehyde	5, 13
2298	---	methyl chloroform	13
2299	---	methyl bromide	1
23[b]	---	ethylene dichloride	4
2311	---	ammonia	13
2321	---	ammonia	13
2328	---	ammonia	13
2329	---	methyl chloroform	13
2335	---	arsenic, ammonia	1, 13
2339	---	ammonia	13
2352	---	arsenic	1
2361	---	ammonia	13
2369	---	toluene	13
2371	---	ammonia, perchloroethylene	13
2387	---	ammonia, cadmium, copper, toluene, zinc	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2389	---	toluene	13
2392	---	toluene, naphthalene	13
2396	---	arsenic, ammonia, benzene, toluene, vinyl chloride	4, 13
2399	---	chlorine	13
2408	---	chlorine, formaldehyde, methyl chloride	13
2411	---	methyl chloride, toluene	13
2421	---	lead, acetaldehyde, formaldehyde, PAH, POM, toluene	1, 5, 13
2426	---	toluene	13
2431	---	methylene chloride, xylene, toluene, carbon tetrachloride, formaldehyde, asbestos, chlorinated phenols	1, 5, 13
2432	---	ammonia, formaldehyde, naphthalene, toluene	13
2434	---	toluene, xylene, methyl chloroform, methylene chloride, naphthalene, styrene	5, 6, 13
2435	---	formaldehyde, perchloroethylene	5
2449	---	toluene	13
2451	---	formaldehyde	5
2479	---	toluene	13
2490	---	formaldehyde, toluene	13
2491	---	arsenic, phenol, chromium, cresol, dibenzofurans, naphthalene, zinc/zinc oxide, copper, toluene, hydrogen chloride	1, 3, 4, 5 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2499	---	formaldehyde, hydrazine, hydrogen chloride, methylene chloride, naphthalene, phenol, toluene	13
25[b]	---	trichloroethylene, perchloroethylene, methylene chloride	
2511	---	methylene chloride, methyl chloroform, trichloroethylene, ammonia, styrene, toluene, xylene, methyl chloroform, naphthalene	5, 13
2512	---	cadmium, copper, lead, toluene	13
2514	---	toluene, xylene, cresol, toluene, trichloroethylene	5, 13
2517	---	toluene	13
2521	---	methylene chloride, formaldehyde, trichloroethylene, methyl chloroform, toluene, xylene, naphthalene, toluene diisocyanate	5, 13
2522	---	methylene chloride, formaldehyde, trichloroethylene, methyl chloroform, toluene, xylene, ammonia, styrene, perchloroethylene, zinc oxide	5, 13
2531	---	ammonia, toluene, xylene	13
2541	---	ammonia, toluene, trichloroethylene, toluene diisocyanate	13
2542	---	methyl chloroform, perchloroethylene, toluene, trichloroethylene, methylene chloride	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2591	---	benzene, methyl chloroform	1, 13
2599	---	methylene chloride, trichloroethylene, phthalic anhydride, toluene	13
26[b]	---	PAH, benzo(a)pyrene, POM	4
2611	---	hydrogen sulfide, chloroform, chlorine	5, 13
2621	---	chloroform, hydrogen sulfide, toluene, arsenic, cadmium, trichloroethylene, chlorine	1, 7, 5, 13
2631	---	cadmium, chloroform, formaldehyde, toluene	5, 7, 13
2641	---	toluene, formaldehyde, arsenic, ammonia, perchloroethylene, methyl chloroform, hydrogen sulfide	1, 5, 6, 13
2643	---	acetaldehyde, ammonia, hydrogen chloride, formaldehyde, methyl chloroform, methylene chloride, naphthalene, toluene, perchloroethylene	13
2644	---	toluene	13
2645	---	toluene, trichloroethylene	6, 13
2646	---	zinc	13
2649	---	formaldehyde, ammonia, toluene	6, 13
2651	---	formaldehyde	13
2652	---	toluene	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2653	---	ammonia, trichloroethylene	13
2654	---	acetaldehyde, ammonia, toluene	13
2655	---	ammonia, toluene	13
2661	---	asbestos, ammonia	6, 13
27[b]	---	toluene	13
2711	---	trichloroethylene	2
2731	---	arsenic, lead	13
2732	---	lead, methyl chloroform	1, 13
2741	---	toluene	13
2750	---	methyl chloroform, toluene	13
2751	---	ammonia, benzene, chromium, toluene, methylene chloride, naphthalene, perchloroethylene, trichloroethylene	13
2752	---	benzene, trichloroethylene, toluene, ammonia	1, 13
2753	---	benzene	1
2754	---	benzene, toluene, xylene, nickel, methyl chloroform, methylene chloride, perchloroethylene, cadmium, trichloroethylene, ammonia, gasoline vapors, formaldehyde	1, 5, 13
2782	---	ammonia, methyl chloride, methyl chloroform, toluene, trichloroethylene	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2789	---	toluene	13
2791	---	ammonia	13
2794	---	lead	1
2799	---	vinyl chloride	13
28[b]	---	bis(chloromethyl) ether, ammonia, carbon tetrachloride, chloroform, copper, cresol, ethylene oxide, lead, formaldehyde, hydrogen chloride, methyl chloroform, methylene chloride, naphthalene, phenol, toluene, toluene diisocyanate	5, 13
2810	---	asbestos, benzene, chlorine, copper, carbon tetrachloride, chloroform, hexachlorocyclopentadiene, hydrogen chloride, methyl chloroform, toluene, perchloroethylene, trichloroethylene	13
2812	---	arsenic, benzene, chlorine/HCl, mercury, carbon tetrachloride, vinyl chloride, vinylidene chloride, toluene, phosgene, 1,3-butadiene, ammonia, asbestos, formaldehyde, chlorobenzene, trichloroethylene, chloroform	1, 5, 10, 12, 13
2813	---	beryllium, arsenic, ethylene oxide, carbon tetrachloride, mercury, hydrogen chloride	1, 5 13
2815	---	ammonia, hydrogen chloride, toluene, phosgene	13

[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2816	---	lead, cadmium, arsenic, chromium, hydrazine, 1,4-dioxane, chloroform, dimethyl sulfate, zinc/zinc oxide, copper, hydrogen chloride, lead, ammonia	1, 4, 5, 10, 13
2818	---	ammonia, benzene, chlorine/HCl, carbon tetrachloride, gasoline vapors, hydrazine, hydrogen sulfide, methyl chloride, methylene chloride, zinc, chlorobenzene, phosgene, toluene	13
2819	3 01 999 99	chlorine/HCl, copper, chromium, nickel, cadmium, arsenic, ammonia, benzene, benzyl chloride, hydrogen sulfide, zinc/zinc oxide, lead, naphthalene, radionuclides, mercury, carbon tetrachloride, xylene, toluene, formaldehyde, methyl chloroform, phenol, phosgene, perchloroethylene, toluene, trichloroethylene	1, 3, 5, 4, 7, 10, 12, 13
2821	3 01 018 01	maleic anhydride, acetaldehyde, acrylonitrile, perchloroethylene, phosgene, propylene oxide, acrolein, vinylidene chloride, toluene, allyl chloride, chloroprene, hydrogen sulfide, styrene, tetrahydrofuran, phenol, cresol, epichlorohydrin, lead, formaldehyde, arsenic, vinyl chloride, ethylene dichloride, benzene, phthalic anhydride, methyl methacrylate, chloroethane, toluene diisocyanate, ammonia, 1,3-butadiene, asbestos, carbon tetrachloride, chlorine/HCl, hydrogen sulfide, mercury, methylene chloride, nitrobenzene, PCB, tetrahydrofuran, trichloroethylene, ethylene oxide, xylene, cadmium, gasoline vapors, zinc oxide	1, 4, 5, 3, 8, 10 12, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2822	---	ethylene dichloride, benzene, toluene diisocyanate, 3,3-dichlorobenzidine, epichlorohydrin, lead, maleic anhydride, acetaldehyde, acrylonitrile, perchloroethylene, methylene chloride, toluene, allyl chloride, chloroprene, styrene, 1,3-butadiene, ammonia, carbon tetrachloride, chlorine/HCl, chloroform, vinylidene chloride	1, 4, 5, 10 12, 13
2823	---	chlorine/HCl, ammonia, arsenic, ethylene dichloride, benzene	1, 10
2824	---	copper, vinylidene chloride, dimethyl sulfate, ethylene dichloride, toluene diisocyanate, acrylonitrile	1, 5, 10, 12 13
2827	---	1,3-butadiene	12, 13
2831	---	lead, arsenic, benzene, ethylene dichloride, methyl chloroform	1, 13
2833	---	toluene, phenol, mercury, methyl bromide, lead, carbon tetrachloride, arsenic, ethylene dichloride, styrene, benzene, methylene chloride, methyl methacrylate, vinylidene chloride, acrylonitrile, ammonia, chloroprene, formaldehyde, chlorine/HCl	1, 6, 5, 13
2834	---	hydrazine, phenol, mercury, lead, 1,4-dichlorobenzene, 1,4-dioxane, epichlorohydrin, carbon tetrachloride, chloroform, arsenic, ethylene dichloride, chromium, ethylene dibromide, benzene, benzyl chloride, methyl chloroform, methylene chloride, phosgene, xylene, toluene, formaldehyde, zinc/zinc oxide, acrylonitrile, allyl chloride, ammonia, chlorine/HCl, ethylene oxide, methyl methacrylate, phosgene, styrene, perchloroethylene, toluene, vinylidene chloride	1, 3, 4, 5, 6, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2840	---	ammonia, chlorine/HCl	13
2841	---	benzene, toluene, formaldehyde, ethylene dichloride, ethylene oxide, hydrogen sulfide, methyl methacrylate	1, 5, 13
2842	---	ammonia, chlorine/HCl, methylene chloride, perchloroethylene, zinc/zinc oxide, nitrobenzene, cresol, 1,4-dichlorobenzene, 1,4-dioxane, epichlorohydrin, carbon tetrachloride, formaldehyde, chloroform, arsenic, methyl chloroform, benzene, toluene, trichloroethylene	1, 4, 5, 3, 10, 13
2843	---	toluene, 1,4-dioxane, benzene, benzyl chloride, propylene oxide, zinc/zinc oxide	1, 4, 6, 10
2844	---	dimethyl sulfate, arsenic, Freon 113, 1,4-dioxane, formaldehyde, benzene, acetaldehyde, acrolein, benzyl chloride, methylene chloride, methyl chloroform, perchloroethylene, methyl chloride, toluene, trichloroethylene, zinc/zinc oxide, ammonia	1, 5, 10, 13
2851	---	epichlorohydrin, zinc/zinc oxide, xylene, toluene, phenol, mercury, nitrobenzene, 1,4-dioxane, copper, perchloroethylene, methylene chloride, acetaldehyde, trichloroethylene, lead, carbon tetrachloride, asbestos, arsenic, benzene, toluene diisocyanate, chlorinated phenols, ammonia, methyl chloride, chromium, cresol, methyl chloroform, formaldehyde, methyl methacrylate, styrene, naphthalene, nickel, phthalic anhydride	1, 3, 4, 5, 6, 8, 10, 13
2860	---	chlorine/HCl, toluene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2861	---	benzo(a)pyrene, POM, PAH, arsenic, formaldehyde, chromium, benzene, toluene diisocyanate, naphthalene	1, 4, 5
2865	---	maleic anhydride, acetaldehyde, acrolein, acrylonitrile, benzyl chloride, toluene diisocyanate, naphthalene, chlorine/HCl, methylene chloride, trichloroethylene, phosgene, xylene, hydrazine, toluene, benzidine, dimethyl sulfate, phenol, formaldehyde, nitrosomorpholine, nitrobenzene, methyl bromide, chlorobenzene, cresol, carbon tetrachloride, 1,4-dichlorobenzene, 1,4-dioxane, PAH, POM, chloroform, arsenic, ethylene dichloride, chromium, benzene, dibenzofurans, phthalic anhydride, hexachlorobenzene, ammonia, pentachlorophenol, 1,3-butadiene, methyl isocyanate, gasoline vapors, styrene, 3,3'-dichlorobenzidine, vinyl chloride, tetrahydrofuran, hydrogen sulfide	1, 3, 4, 5, 10, 12 13
2869	---	Freon 113, chlorine/HCl, naphthalene, phthalic anhydride, chloroethane, methyl isocyanate, maleic anhydride, acetaldehyde, acrolein, acrylonitrile, benzyl chloride, methyl chloroform, trichloroethylene, chromium, benzene, perchloroethylene, methylene chloride, hexachlorobenzene, phosgene, propylene oxide, vinylidene chloride, xylene, hydrazine, toluene, allyl chloride, benzidine, ethylene dibromide, methyl chloride, phenol, nitrosomorpholine, formaldehyde, nitrobenzene, chloroform, epichlorohydrin, ethylene oxide, carbon tetrachloride, arsenic, ethylene dichloride, chlorobenzene, ammonia, formaldehyde, hexachlorocyclopentadiene, hydrogen sulfide, mercury, methyl methacrylate, phenol, styrene, toluene diisocyanate, vinyl chloride, xylene, zinc oxide, gasoline vapors, asbestos, acetaldehyde, 1,3-butadiene, 1,4-dichlorobenzene	1, 3, 4, 5, 6, 8, 10, 12 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2870	---	methylene chloride	13
2872	---	ammonia	13
2873	3 01 040 07	lead, cadmium, nickel, ammonia, hydrogen sulfide	1, 7, 10, 13
2874	---	hydrogen sulfide, cadmium, arsenic, ammonia	1, 5, 10
2875	---	ammonia	10
2879	---	chlorine/HCl, copper, naphthalene, zinc/zinc oxide, methyl isocyanate, 1,4-dichlorobenzene, arsenic, mercury, 1,3-butadiene, methyl bromide, cadmium, maleic anhydride, phenol, lead, ethylene dichloride, phthalic anhydride, hexachlorocyclopentadiene, acrolein, chlorobenzene, ethylene dibromide, hexachlorobenzene, phosgene, acrylonitrile, hydrazine, dimethyl sulfate, cresol, carbon tetrachloride, formaldehyde, chloroform, benzene, acetaldehyde, ammonia, arsenic, methyl chloride, ethylene oxide, methylene chloride, vinyl chloride, xylene	1, 4, 5, 10 12, 13
2891	---	trichloroethylene, xylene, toluene, nitrosomorpholine, 1,4-dioxane, lead, arsenic, ethylene dichloride, benzene, ammonia, asbestos, methylene chloride, methyl chloroform	1, 10 13
2892	---	mercury, formaldehyde, arsenic, phenol, ammonia, acetaldehyde, toluene, nitrobenzene, lead	1, 3, 4 5, 6, 10, 13
2893	---	formaldehyde, arsenic, benzene, zinc, perchloroethylene, xylene, toluene, lead, vinyl chloride, ammonia, copper, cadmium	1, 4, 8, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2895	---	benzo(a)pyrene, POM, PAH, ammonia	5, 13
2899	---	hexachlorocyclopentadiene, xylene, copper, hydrazine, lead, cadmium, formaldehyde, arsenic, chromium, benzene, methyl methacrylate, maleic anhydride, ammonia, methyl chloride, perchloroethylene, toluene, vinyl chloride, trichloroethylene, methyl isocyanate, chlorine/HCl, hydrogen sulfide, styrene, radionuclides, zinc/zinc oxide	1, 4, 10, 13
2911	3 06 001 02 3 06 002 01 3 06 009 01 1 01 007 01 1 01 007 02 1 02 007 01 1 02 007 02 1 02 007 03 1 01 004 01 1 01 004 02 1 01 004 03 1 01 005 01 1 01 005 02 1 01 005 03	arsenic, beryllium, cresol, PAH, dimethyl sulfate, maleic anhydride, xylene, toluene, benzo(a)pyrene, phenol, mercury, lead, formaldehyde, cadmium, ethylene dichloride, POM, ethylene dibromide, nickel, chromium, benzene, coke oven emissions, ammonia, naphthalene, gasoline vapors, hydrogen sulfide, acetaldehyde, chlorine/HCl, zinc/zinc oxide	1, 3, 4, 5, 6, 8, 10, 11, 13
2918	---	hydrogen chloride	13
2921	---	toluene, benzo(a)pyrene, benzene, formaldehyde	1
2951	3 05 002 01	toluene, benzo(a)pyrene, mercury, POM, formaldehyde, PAH, chromium, benzene, asbestos, ammonia, methyl chloroform, methyl isocyanate	1, 4, 13
2952	3 05 001 01	formaldehyde, PAH, asbestos, POM, chromium, carbon tetrachloride	4, 6, 8, 13
2991	---	formaldehyde	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
2992	---	methyl chloroform, trichloroethylene asbestos, benzene, epichlorohydrin, formaldehyde, hydrogen sulfide, toluene, xylene	4, 5, 13
2999	---	chromium, naphthalene, gasoline vapors	5, 10,
3011	---	ammonia, benzene, methyl chloroform, methylene chloride, styrene, zinc oxide, toluene	13
3021	---	methyl chloroform, naphthalene, toluene	13
3029	---	methyl isocyanate, vinyl chloride	13
3031	---	lead, cadmium, benzene, toluene, naphthalene	1, 13
3041	---	toluene, perchloroethylene	6, 13
3060	---	naphthalene, toluene	13
3069	---	lead, benzene, chlorine/HCl, methyl chloroform, methylene chloride, toluene diisocyanate, ammonia, ethylene oxide, formaldehyde, naphthalene, perchloroethylene, zinc/zinc oxide, styrene, toluene, vinyl chloride	1, 10, 12, 13
3079	---	benzyl chloride, chlorine/HCl, lead, methylene chloride, phenol, mercury, beryllium, ethylene oxide, methyl methacrylate, formaldehyde, ethylene dichloride, styrene, vinyl chloride, toluene diisocyanate, acetaldehyde, acrylonitrile, ammonia, benzene, zinc oxide, naphthalene, phthalic anhydride, tetrahydrofuran, toluene, methyl chloride, trichloroethylene, Freon 113, gasoline vapors, hydrogen sulfide, methyl chloroform	1, 4, 6, 5, 10, 12, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3111	---	chromium, lead, formaldehyde, copper, toluene, naphthalene, arsenic	1, 4, 5, 13
3126	---	ammonia, trichloroethylene	13
3141	---	toluene	13
3143	---	toluene	13
3172	---	toluene, trichloroethylene	13
3194	---	lead, benzene	1
3199	---	methyl chloroform, toluene	13
32[b]	---	ammonia, arsenic, cadmium, nickel, chromium, chlorine/HCl, lead, mercury, methyl chloroform, toluene, trichloroethylene	13
3208	---	methyl chloroform, trichloroethylene	13
3211	3 05 014 02	cadmium, chromium, arsenic, nickel, ammonia, chlorine/HCl, toluene	1, 4, 13
3216	---	perchloroethylene	13
3220	---	ammonia, copper, chlorine/HCl, nickel, toluene	13
3221	---	arsenic, chlorine/HCl, methylene chloride	1, 13
3229	---	arsenic, chlorine/HCl, mercury, formaldehyde, lead, methyl chloroform, methylene chloride, styrene, toluene, perchloroethylene, cadmium, chromium	1, 10, 13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3231	---	ammonia, toluene, trichloroethylene, xylene	13
3241	3 05 007 06	chromium, copper, mercury, arsenic, nickel, cadmium, chlorine/HCl, lead, zinc, toluene	1, 3, 5, 10, 13
3251	---	beryllium, lead, arsenic	1
3253	---	beryllium, lead, arsenic	1
3255	---	beryllium, chromium, mineral fibers	1, 10
3261	---	styrene, toluene	13
3263	---	toluene	13
3264	---	beryllium, trichloroethylene, zinc, xylene, ammonia, methyl chloride, copper, lead, hydrogen sulfide, methyl bromide, naphthalene, toluene, perchloroethylene	1, 13
3269	---	lead, methyl chloroform	1, 13
3271	---	styrene, chromium	5, 13
3272	---	ammonia, gasoline vapors, toluene, chromium, zinc	5, 13
3273	---	asbestos, hydrogen sulfide	13
3274	---	mercury	1
3281	---	trichloroethylene	13
3291	3 05 009 99	ammonia, cadmium, formaldehyde, chromium, chlorine/HCl, lead, manganese, methyl chloroform, zinc, methylene chloride, phenol, styrene, perchloroethylene, toluene, xylene	1, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3292	---	asbestos, copper, formaldehyde, hydrogen sulfide, methyl chloroform, naphthalene, xylene, chromium, benzene	1, 5, 13
3293	---	ammonia, asbestos, gasoline vapors, hydrogen chloride, lead, toluene, chlorobenzene, trichloroethylene, zinc	13
3295	---	chlorine/HCl, chromium, gasoline vapors, copper	10, 13
3296	---	ammonia, carbon tetrachloride, phenol, formaldehyde, mineral fibers	10, 13
3297	---	beryllium, chromium, mineral fibers, ammonia, formaldehyde, hydrogen chloride, phenol, zinc/zinc oxide	1, 4, 10, 13
3299	---	mineral fibers, copper, styrene, chlorine/HCl, toluene	10, 13
3300	---	hydrogen chloride, methyl chloroform, naphthalene, tetrahydrofuran, vinyl chloride, zinc/zinc oxide	13
3312	3 03 008 03 3 03 009 01 3 03 009 03 3 03 004 07	chlorine/HCl, chromium, coke oven emissions, toluene, xylene, phenol, cadmium, mercury, beryllium, lead, manganese, PAH, arsenic, nickel, benzene, naphthalene, POM, ammonia, formaldehyde, hydrogen sulfide, zinc, toluene, trichloroethylene	3, 4, 5, 1, 7, 10, 12, 13
3313	3 03 007 01	nickel, manganese, cadmium, arsenic, chromium, copper	1, 3, 4, 13
3315	---	PCB, lead, ammonia, chlorine/HCl, methyl chloride, toluene, zinc	1, 13
3316	---	methylene chloride, toluene	13
3317	---	ammonia, perchloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3321	3 04 003 03 3 04 003 01	acetaldehyde, xylene, arsenic, lead, beryllium, manganese, cadmium, zinc, nickel, chromium, toluene, styrene, naphthalene, phenol, acrolein, ammonia, benzene, copper, hydrogen sulfide, formaldehyde, methyl chloroform	1, 4, 7, 13
3322	---	ammonia, formaldehyde, zinc	13
3323	---	hydrogen chloride, methyl chloroform	13
3324	---	cadmium, chromium	3
3325	---	arsenic, ammonia, cadmium, methyl chloride, chromium, copper, hydrogen chloride, lead, methyl chloroform, naphthalene, nickel, phenol, styrene, perchloroethylene, toluene, xylene, zinc	1, 3, 13
3331	3 03 005 03	nickel, chromium, copper, arsenic, mercury, cadmium, zinc/zinc oxide	5, 7, 10, 13
3332	3 03 010 09 3 03 010 03 3 03 010 05 3 03 010 08 3 03 010 25 3 03 010 24 3 03 010 02 3 03 010 01	chromium, arsenic, mercury, lead, cadmium, nickel, zinc/zinc oxide	1, 7, 10
3333	---	cadmium, zinc/zinc oxide, mercury, lead	1, 10
3334	---	chlorine/HCl, phosgene	13
3339	---	chlorine/HCl, nickel, lead, cadmium, arsenic, zinc/zinc oxide, ammonia, copper	1, 4, 6 10, 12, 13

TABLE C-1. Continued

SIC Code	SCC Code^a	Potential Pollutant	Reference (page C-50)
3341	3 04 001 07 3 04 004 03	zinc/zinc oxide, copper, chromium, arsenic, nickel, lead, cadmium, ammonia, chlorine/HCl, styrene	1, 5, 7, 10,
3350	---	chromium, hydrogen chloride	13
3351	---	lead, zinc/zinc oxide, copper, nickel, cadmium	1, 10, 12, 13
3352	---	chlorine/HCl, toluene	13
3354	---	chlorine/HCl	13
3355	---	lead, chlorine/HCl, zinc/zinc oxide	1, 13
3356	---	lead, nickel, zinc/zinc oxide, ammonia, perchloroethylene, hydrogen chloride	1, 4, 10, 13
3357	---	cresol, hydrogen chloride, toluene, naphthalene, vinyl chloride	4, 13
3360	---	copper, zinc	13
3361	---	ammonia, benzene, chlorine/HCl, zinc, copper, formaldehyde, methyl chloroform, phenol, styrene, toluene	13
3362	---	chromium, copper, methyl chloride, lead, ammonia, formaldehyde, methyl chloroform, trichloroethylene, methyl chloride, lead, methylene chloride, chlorobenzene, phenol, toluene, zinc	5, 10, 13
3369	---	beryllium, zinc/zinc oxide, copper, lead, toluene, perchloroethylene, styrene, ammonia, chlorine/HCl	4, 10, 13
3391	---	toluene	13
3392	---	hydrogen chloride	13
3398	---	lead, ammonia, trichloroethylene	1, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3399	---	ammonia, chromium, manganese	13
34[b]	--	trichloroethylene, perchloroethylene, methylene chloride, formaldehyde, ammonia, toluene	13
3411	---	methyl chloroform, xylene, toluene, perchloroethylene, benzene, lead	5, 6, 13
3412	---	ammonia, methyl chloroform, toluene, naphthalene	13
3421	---	lead, chromium, trichloroethylene, toluene	1, 13
3423	---	ammonia, chromium, chlorine/HCl, methyl chloroform, methylene chloride, styrene, toluene, zinc, trichloroethylene	13
3425	---	copper, lead, nickel, toluene, zinc, trichloroethylene	13
3429	---	perchloroethylene, ammonia, copper, chlorine/HCl, chromium, hydrogen sulfide, lead, methyl chloroform, methylene chloride, naphthalene, phenol, toluene, trichloroethylene, zinc/zinc oxide	13
3431	---	methylene chloride, toluene	13
3432	---	ammonia, cadmium, formaldehyde, hydrogen chloride, phenol, toluene, trichloroethylene, zinc oxide	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3433	---	ammonia, benzene, chromium, phenol, formaldehyde, perchloroethylene, toluene	13
3440	---	toluene	13
3441	---	xylene, toluene, copper, zinc oxide	6, 13
3442	---	methyl chloroform, xylene, toluene, ammonia, cadmium, formaldehyde, zinc, perchloroethylene	1, 6, 13
3443	---	methyl chloroform, copper, styrene, trichloroethylene, perchloroethylene, tetrahydrofuran, toluene, gasoline vapors, hydrogen chloride, lead	1, 13
3444	---	trichloroethylene, perchloroethylene, methyl chloroform, toluene, ammonia, toluene diisocyanate	1, 13
3446	---	trichloroethylene, perchloroethylene, methyl chloroform, ammonia, copper, toluene	1, 13
3447	---	toluene	13
3448	---	toluene, xylene	5
3449	---	benzene, ammonia, toluene	1, 13
3451	---	methyl chloroform, trichloroethylene	13
3452	---	cadmium, hydrogen chloride, methyl chloroform, methylene chloride, trichloroethylene, zinc	13
3461	---	benzene, carbon tetrachloride, methyl chloroform, methylene chloride, naphthalene, perchloroethylene, toluene, trichloroethylene	13
3462	---	hydrogen sulfide	13

TABLE C-1. Continued

SIC Code	SCC Code^a	Potential Pollutant	Reference (page C-50)
3465	---	ammonia, methyl chloride, methylene chloride, perchloroethylene, toluene	13
3466	---	lead	1
3469	---	trichloroethylene, perchloroethylene, methyl chloroform, copper, toluene	1, 10, 13
3470	---	toluene	13
3471	---	copper, chromium, cadmium, arsenic, lead, zinc/zinc oxide, nickel, benzene, acrolein, ammonia, methyl chloroform, chlorine/HCl, methylene chloride, nitrobenzene, formaldehyde, perchloroethylene, trichloroethylene, toluene	1, 6, 10, 13
3477	---	chromium	13
3479	---	arsenic, benzene, lead, nickel, zinc/zinc oxide, acetaldehyde, xylene, cadmium, ammonia, chromium, copper, chlorine/HCl, methyl chloroform, methylene chloride, perchloroethylene, toluene, trichloroethylene	1, 10, 13
3482	---	lead	1, 13
3483	---	hydrogen sulfide, trichloroethylene, toluene	13
3484	---	ammonia, formaldehyde, hydrogen chloride, lead, arsenic, phenol, toluene, Freon 113, zinc oxide	1, 13
3490	---	toluene	13
3492	---	toluene	13
3493	---	hydrogen chloride, methyl chloroform, toluene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3494	---	copper, methyl chloroform, phenol, toluene, trichloroethylene, zinc	13
3496	---	methyl chloroform, ammonia, hydrogen chloride, nickel, perchloroethylene, toluene, vinyl chloride	6, 13
3497	---	lead, zinc/zinc oxide, copper, ammonia, hydrogen chloride, perchloroethylene	1, 10, 13
3499	---	trichloroethylene, toluene, Freon 113, acrylonitrile, ammonia, 1,3-butadiene, cadmium, chlorine/HCl, copper, lead, formaldehyde, hydrazine, mercury, methyl chloroform, methyl chloride, styrene, perchloroethylene, zinc	6, 10, 13
35[b]	---	Freon 113, methyl chloroform	10, 13
3511	---	ammonia, formaldehyde, hydrogen chloride, maleic anhydride, methyl chloroform, phenol, styrene, toluene, perchloroethylene, xylene, toluene diisocyanate	13
3519	---	hydrazine, ethylene dichloride, ethylene dibromide, benzene, gasoline vapors, ammonia, methyl chloroform	1, 5, 4, 9, 13
3522	---	toluene	13
3523	---	toluene	13
3531	---	carbon tetrachloride, hydrogen chloride, perchloroethylene, toluene	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3533	---	xylene, nickel, chromium, lead, methyl chloroform	6, 13
3534	---	toluene	13
3535	---	ammonia, toluene, trichloroethylene	13
3536	---	ammonia, cadmium, copper, lead, zinc	13
3537	---	toluene, perchloroethylene	13
3540	---	perchloroethylene	13
3541	---	lead, ammonia, trichloroethylene, toluene	1, 13
3542	---	benzene, lead, ammonia, toluene, methyl chloroform, trichloroethylene, perchloroethylene	1, 13
3544	---	methyl chloride, 1,4-dichlorobenzene, formaldehyde, hydrogen chloride, methyl chloroform, methylene chloride, naphthalene, tetrahydrofuran, toluene, trichloroethylene, zinc	13
3545	---	beryllium, ammonia, chromium, hydrogen chloride, methyl chloroform, toluene, trichloroethylene	1, 13
3547	---	cadmium, chromium, zinc/zinc oxide	1, 10
3548	---	chromium, toluene	13
3549	---	copper, nickel, zinc, toluene	13
3551	---	arsenic	1
3552	---	trichloroethylene, toluene, xylene	5, 13
3553	---	chlorine/HCl, toluene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3554	---	trichloroethylene, perchloroethylene, ammonia, toluene	2, 13
3555	---	lead, ammonia, chromium, methyl chloroform, methylene chloride, zinc oxide, toluene, toluene diisocyanate	1, 13
3559	---	methyl chloroform, benzene, arsenic, lead, ammonia, perchloroethylene, copper, chromium, trichloroethylene, toluene	1, 13
3561	---	ammonia, formaldehyde, hydrogen chloride, lead, methyl chloroform, phenol, perchloroethylene, toluene, xylene	13
3562	---	copper, methyl chloroform, toluene, naphthalene	10, 13
3563	---	toluene	13
3564	---	copper, gasoline vapors, lead, methyl chloroform, toluene, trichloroethylene	13
3565	---	formaldehyde, phenol	13
3566	---	methyl chloroform, perchloroethylene, toluene	13
3567	---	arsenic, lead, copper, toluene, zinc, trichloroethylene, hydrogen chloride	1, 10, 13
3568	---	copper, ammonia, hydrogen chloride	10, 13
3569	---	ammonia, chromium, copper, cresol, epichlorohydrin, formaldehyde, lead, hydrogen chloride, methyl chloroform, nickel, phenol, toluene, zinc oxide, trichloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3572	---	benzene, cadmium, formaldehyde, lead, nickel, xylene, toluene, beryllium, hydrogen chloride, ammonia	6, 13
3573	---	methyl chloroform, methylene chloride, ammonia, arsenic, asbestos, benzene, benzo(a)pyrene, benzidine, chloroform, bis(chloromethyl) ether, chlorine/HCl, methyl chlorine, chromium, copper, Freon 113, hydrogen sulfide, lead, methyl chloroform, methylene chloride, naphthalene, nickel, nitrobenzene, phenol, perchloroethylene, toluene, tetrahydrofuran, trichloroethylene, vinyl chloride, zinc	1, 6, 13
3574	---	arsenic, hydrogen chloride, methyl chloroform	13
3579	---	hydrogen chloride, methyl chloride, toluene	13
3581	---	toluene	13
3582	---	arsenic, perchloroethylene, toluene	1, 13
3585	---	toluene, xylene, ammonia, copper, formaldehyde, hydrogen sulfide, lead, methyl chloroform, methylene chloride, phthalic anhydride, toluene, Freon 113, trichloroethylene, zinc	5, 13
3586	---	toluene	13
3589	---	toluene	13
3592	---	nickel, ammonia, formaldehyde	1, 13
3599	---	ammonia, formaldehyde, methyl chloroform, methylene chloride, phenol, toluene, trichloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
36[b]	---	Freon 113, trichloroethylene, perchloroethylene, methylene chloride	10
3610	---	ammonia, toluene	13
3611	---	ammonia, hydrogen chloride, lead, mercury, methyl chloroform, toluene, perchloroethylene, trichloroethylene	13
3612	---	xylene, beryllium, PCB, ammonia, lead, hydrogen chloride, methyl chloroform, methylene chloride, naphthalene, zinc oxide, toluene, vinyl chloride, phenol, trichloroethylene, perchloroethylene	1, 4, 6, 13
3613	---	ammonia, formaldehyde, hydrogen chloride, methyl chloroform, toluene, perchloroethylene, trichloroethylene	13
3619	---	methyl chloroform, naphthalene, trichloroethylene	13
3620	---	arsenic, lead, toluene	13
3621	---	methyl chloroform, ammonia, lead, formaldehyde, hydrogen chloride, styrene, toluene, trichloroethylene, naphthalene, phenol	2, 13
3622	---	ammonia, styrene, toluene, methyl chloroform, trichloroethylene	13
3623	---	nickel, toluene	13
3624	---	benzo(a)pyrene, chlorine/HCl, hydrogen sulfide, styrene	13

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[b] Where 2 digit SIC codes are presented with a group of pollutants, some data indicate that the pollutants shown are likely to be associated with a broad classification represented by a 2 digit SIC code. No data were found to link those pollutants with a more specific 4 digit SIC code. The pollutants are listed by 2 digit SIC code to provide more information, even though it is not as specific.

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3629	---	mercury, PCB, copper, ammonia, benzo(a)pyrene, hydrogen chloride, methyl chloroform, perchloroethylene, trichloroethylene	1, 4, 10, 13
3631	---	methyl chloroform, trichloroethylene	13
3632	---	toluene	13
3633	---	toluene, perchloroethylene	13
3634	---	beryllium, toluene	1, 13
3636	---	toluene, methyl chloroform	13
3641	---	mercury, ammonia, cadmium, methyl chloroform, toluene, trichloroethylene	1, 13
3642	---	mercury, ammonia, formaldehyde, zinc, hydrogen chloride, lead, methyl chloroform, naphthalene, phenol, perchloroethylene, toluene, xylene, trichloroethylene, vinylidene chloride	1, 13
3643	---	methyl chloroform, ammonia, copper, formaldehyde, hydrogen chloride, manganese, methyl chloroform, nickel, methylene chloride, phenol, toluene, perchloroethylene, trichloroethylene, toluene diisocyanate, zinc	5, 13
3644	---	copper, hydrogen chloride, styrene, toluene, trichloroethylene, vinyl chloride, zinc	13
3645	---	ammonia, hydrazine, methyl chloroform, toluene, trichloroethylene	13
3646	---	methyl chloroform, toluene	13
3648	---	toluene, trichloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3651	---	xylene, toluene, ammonia, methyl chloroform, toluene, trichloroethylene	1, 13
3661	---	perchloroethylene, trichloroethylene, methylene chloride, xylene, toluene, methyl chloroform, hydrogen chloride, perchloroethylene, styrene, ammonia, copper, methyl chloride, formaldehyde	5, 6, 13
3662	---	methyl chloroform, ammonia, benzene, chlorine/HCl, methyl chloride, copper, formaldehyde, hydrogen sulfide, lead, methylene chloride, perchloroethylene, toluene, toluene diisocyanate, xylene, trichloroethylene, zinc	2, 13
3670	---	ammonia, methyl chloride, copper, gasoline vapors, hydrazine, hydrogen chloride, lead, methyl chloroform, methylene chloride, phenol, styrene, perchloroethylene, tetrahydrofuran, toluene, toluene diisocyanate, zinc oxide, trichloroethylene	13
3672	---	beryllium, lead	1
3673	---	ammonia, beryllium, benzene, cadmium, chromium, copper, hydrogen chloride, lead, nickel, styrene, toluene, trichloroethylene, xylene	1, 13
3674	---	trichloroethylene, perchloroethylene, methyl chloroform, xylene, beryllium, arsenic, lead, phenol, ammonia, zinc, chlorine/HCl, mercury, methylene chloride, chlorobenzene, nickel, phenol, styrene, toluene, toluene diisocyanate	1, 2, 6, 13
3675	---	allyl chloride, chromium, methylene chloride, epichlorohydrin, lead, methyl chloroform, trichloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3679	---	perchloroethylene, beryllium, benzene, chromium, methyl chloroform, xylene, methyl chloride, methylene chloride, acetaldehyde, ammonia, arsenic, benzyl chloride, cadmium, chlorine/HCl, copper, chloroform, ethylene dichloride, lead, epichlorohydrin, formaldehyde, gasoline vapors, hydrogen sulfide, manganese, mercury, naphthalene, nickel, PCB, zinc/zinc oxide, phenol, phosgene, styrene, tetrahydrofuran, toluene, toluene diisocyanate, trichloroethylene	1, 2, 4, 8, 9, 13
3691	---	zinc/zinc oxide, methyl chloroform, beryllium, lead, manganese, cadmium, nickel	1, 4, 6, 10
3692	---	cadmium, nickel, lead, zinc/zinc oxide, naphthalene	1, 4, 10, 13
3693	---	toluene, beryllium, zinc oxide, hydrogen chloride, trichloroethylene	1, 6, 13
3694	---	beryllium, hydrogen chloride, methyl chloroform, toluene, perchloroethylene	1, 13
3699	---	beryllium, perchloroethylene, methyl chloroform, toluene, lead, copper, vinyl chloride, xylene, zinc	1, 13
37[b]	---	trichloroethylene, perchloroethylene, methylene chloride	
3710	---	toluene	13

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TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3711	---	ammonia, cadmium, chromium, hydrogen chloride, formaldehyde, lead, phenol, methylene chloride, toluene	13
3713	---	chromium, nickel, methylene chloride, styrene, toluene	5, 13
3714	---	methyl chloroform, chromium, ammonia, cadmium, zinc/zinc oxide, copper, asbestos, benzene, chlorine/HCl, lead, formaldehyde, hydrogen sulfide, manganese, methylene chloride, toluene, naphthalene, perchloroethylene, toluene diisocyanate, trichloroethylene	2, 5, 10, 12, 13
3717	---	ammonia, asbestos, hydrogen chloride, lead, methylene chloride, toluene, trichloroethylene, zinc oxide	13
3721	---	ammonia, chromium, hydrogen chloride, hydrogen sulfide, lead, methyl chloroform, methylene chloride, nickel, styrene, perchloroethylene, toluene, trichloroethylene, xylene, zinc	13
3722	---	hydrogen chloride, methylene chloride, nickel, trichloroethylene	13
3728	---	methyl chloroform, ammonia, hydrogen chloride, methylene chloride, toluene, perchloroethylene, trichloroethylene, zinc oxide	2, 13
3729	---	ammonia, toluene	13
3731	---	asbestos	5
3732	---	styrene	13
3742	---	ammonia, hydrogen chloride, methyl chloroform, methylene chloride, toluene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3743	---	chromium, nickel, ammonia, toluene diisocyanate	5, 13
3751	---	toluene	13
3761	---	trichloroethylene, perchloroethylene, xylene, hydrazine, toluene, formaldehyde	1
3764	---	hydrazine, trichloroethylene	1, 13
3769	---	hydrazine, ammonia, hydrogen chloride, lead, methylene chloride, toluene	1, 13
3799	---	hydrogen chloride, methylene chloride, toluene	13
38[b]	---	Freon 113, methyl chloroform, toluene	13
3810	---	formaldehyde	13
3811	---	beryllium, arsenic, lead, ammonia, zinc, asbestos, cadmium, chromium, copper, hydrogen chloride, methyl chloroform, methylene chloride, phenol, toluene, perchloroethylene, trichloroethylene	1, 13
3821	---	ammonia, chloroform, chromium, copper, formaldehyde, hydrogen chloride, lead, mercury, methyl chloroform, toluene, toluene diisocyanate, zinc oxide, trichloroethylene	13

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TABLE C-1. Continued

SIC Code	SCC Code^a	Potential Pollutant	Reference (page C-50)
3822	---	beryllium, chlorine/HCl, mercury, trichloroethylene	1, 13
3823	---	beryllium, lead, cadmium, hydrogen chloride, toluene, zinc/zinc oxide	1, 5, 13
3825	---	methyl chloroform, beryllium, toluene	1, 6, 13
3829	---	mercury, ethylene oxide, ammonia, toluene	1, 6, 13
3831	---	ammonia, chromium, ethylene oxide, hydrogen chloride, methyl chloroform, methylene chloride, naphthalene, nickel, toluene, trichloroethylene, Freon 113	13
3832	---	acetaldehyde, trichloroethylene, methyl chloroform, methylene chloride, formaldehyde, toluene	2, 4, 13
3840	---	ammonia, hydrogen chloride, toluene, trichloroethylene	13
3841	---	ethylene oxide, formaldehyde, methyl chloroform, perchloroethylene, zinc, toluene, trichloroethylene	5, 6, 13
3842	---	methyl chloroform, ethylene oxide, ammonia, chromium, formaldehyde, hydrogen chloride, lead, nickel, tetrahydrofuran, toluene, vinylidene chloride	2, 4, 5, 12, 13
3843	---	cadmium, ethylene oxide, zinc/zinc oxide, ammonia, chlorine, methyl chloroform, formaldehyde, phenol, toluene	1, 5, 10, 13
3851	---	methyl chloroform, trichloroethylene, ammonia	6, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3861	---	benzyl chloride, methyl chloroform, xylene, hydrazine, toluene, ammonia, formaldehyde, chloroform, ethylene dichloride, acetaldehyde, methylene chloride, benzene, zinc/zinc oxide, acrylonitrile, arsenic, asbestos, benzene, benzidine, bis(chloromethyl) ether, cadmium, carbon tetrachloride, chlorine/HCl, chloroform, chromium, ethylene dichloride, dimethyl sulfate, 1,4-dioxane, epichlorohydrin, lead, formaldehyde, hydrazine, mercury, chlorobenzene, naphthalene, nickel, phenol, phosgene, propylene oxide, styrene, vinylidene chloride, toluene diisocyanate, perchloroethylene, tetrahydrofuran, vinyl chloride, trichloroethylene	1, 5, 6, 10, 13
3871	---	toluene	13
3873	---	hydrogen chloride, trichloroethylene	13
39[b]	---	trichloroethylene, perchloroethylene, methylene chloride, toluene	10, 13
3911	---	methyl chloroform, ammonia, hydrogen chloride, lead, toluene, Freon 113, trichloroethylene	2, 13
3914	---	beryllium, ammonia, hydrogen chloride, lead, trichloroethylene	1, 13
3915	---	lead, ammonia, hydrogen chloride	1, 13
3931	---	lead, toluene, trichloroethylene	1, 13

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TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
3941	---	methyl chloroform, styrene, toluene, perchloroethylene	13
3942	---	acrylonitrile, toluene	13
3943	---	methyl chloroform	13
3944	---	toluene, styrene	13
3949	---	styrene, perchloroethylene, toluene	13
3951	---	chlorine, methylene chloride, toluene, perchloroethylene, trichloroethylene	13
3952	---	copper, formaldehyde, toluene	10, 13
3953	---	lead, toluene, trichloroethylene, zinc	13
3955	---	toluene	13
3961	---	ammonia, chlorine/HCl, lead, toluene, perchloroethylene, trichloroethylene	13
3962	---	toluene	13
3963	---	formaldehyde, styrene, toluene, trichloroethylene	13
3964	---	formaldehyde, hydrogen chloride, lead, toluene, trichloroethylene, zinc	13
3993	---	beryllium, ammonia, hydrogen chloride, methyl chloroform, naphthalene, toluene, perchloroethylene, trichloroethylene, zinc	1, 13
3995	---	toluene	13
3996	---	benzene	1
3999	---	arsenic, ammonia, hydrogen chloride, methylene chloride, styrene, toluene, trichloroethylene, zinc/zinc oxide	1, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
4091	---	mercury	1
4111	---	asbestos, formaldehyde, toluene	13
4131	---	copper, nickel, toluene	13
4212	---	toluene	13
4226	---	ammonia, benzene, 1,3-butadiene, xylene, ethylene dichloride, gasoline vapors, hydrogen chloride, methyl methacrylate, methylene chloride, styrene, toluene	13
4231	---	chromium, toluene	13
4463	---	ethylene dichloride, methylene chloride, toluene, perchloroethylene, methyl chloroform, trichloroethylene, xylene	13
4469	---	lead, toluene diisocyanate	1
4582	---	toluene	13
4612	---	hydrogen sulfide	13
4613	---	gasoline vapors	1
4742	---	methyl chloroform, xylene, toluene, ammonia	1, 13
4782	---	toluene	13
4811	---	toluene	13
4899	---	beryllium	1
4911	---	formaldehyde, acetaldehyde, cadmium, benzo(a)pyrene, PAH, POM, mercury, beryllium, manganese, nickel, PCB, benzene, chromium, arsenic, copper, lead	1, 3, 4, 5, 13
4922	---	benzene, hydrogen sulfide, toluene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
4923	---	toluene	13
4924	---	mercury	1
4925	---	hydrogen sulfide	13
4931	---	copper, methyl chloroform, PCB	13
4932	---	hydrogen sulfide	13
4941	---	trichloroethylene, perchloroethylene, arsenic, chromium, hydrogen chloride, hydrogen sulfide, mercury, methyl chloroform, perchloroethylene, vinyl chloride, trichloroethylene	12, 13
4952	---	ammonia, arsenic, cadmium, chromium, copper, hydrogen chloride, lead, mercury, nickel, zinc	13
4953	---	chlorine/HCl, lead, cadmium, nickel, manganese, PAH, POM, chromium, PCB, arsenic, beryllium, mercury, ammonia, copper, toluene, vinyl chloride, zinc	3, 4, 5, 12
4959	---	benzene, chloroform, perchloroethylene, ethylene dichloride, methylene chloride, methyl chloroform, trichloroethylene, vinyl chloride	13
4961	---	toluene, formaldehyde, benzene	1
5013	---	asbestos, formaldehyde	13
5021	---	toluene	13
5039	---	toluene diisocyanate	1
5042	---	toluene	13
5052	---	zinc/zinc oxide	10

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
5074	---	hydrogen chloride	13
5078	---	naphthalene, toluene	13
5081	---	toluene	13
5084	---	toluene	13
5085	---	hydrogen chloride	13
5086	---	ammonia	13
5092	---	gasoline vapors	13
5093	---	ammonia, asbestos, chromium, copper, hydrogen chloride	13
5094	---	ammonia	13
5096	---	ammonia	13
5111	---	naphthalene	13
5113	---	toluene	13
5153	---	ammonia	13
5161	---	ammonia, benzene, 1,3-butadiene, hydrogen chloride, methylene chloride, styrene, toluene, methyl chloroform, vinyl chloride	13
5171	---	gasoline vapors, xylene, toluene, ethylene dibromide, benzene, benzyl chloride, carbon tetrachloride, chlorine/HCl, ethylene dichloride, formaldehyde, methyl methacrylate, styrene, tetrahydrofuran	1, 5, 6, 13
5172	---	ethylene dibromide, gasoline vapors, benzene, hydrogen sulfide, toluene	5, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
5191	---	perchloroethylene, ammonia	6, 13
5194	---	benzene, toluene, xylene	5
5211	---	toluene	13
5212	---	toluene	13
5341	---	toluene	13
5511	---	toluene	13
5531	---	trichloroethylene	13
5541	---	xylene, toluene, ethylene dichloride, benzene, gasoline vapors	8
5551	---	toluene	13
5599	---	toluene	13
5710	---	toluene	13
5712	---	ammonia, methyl chloroform, toluene, methylene chloride	13
5944	---	hydrogen chloride	13
5984	---	toluene	13
5999	---	toluene	13
6324	---	ethylene oxide, hydrogen chloride	13
6499	---	toluene	13
6512	---	acetaldehyde, ammonia, cadmium, lead, chromium, formaldehyde, naphthalene, methyl chloroform, phenol, styrene, perchloroethylene, toluene, xylene, trichloroethylene, vinyl chloride, zinc	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
6513	---	ammonia, copper, hydrogen chloride, hydrogen sulfide, methyl chloroform, methylene chloride, naphthalene, zinc/zinc oxide, perchloroethylene, toluene, vinyl chloride, trichloroethylene	13
6514	---	ammonia, manganese, methyl chloroform, styrene, perchloroethylene, toluene, trichloroethylene, vinyl chloride	13
7210	---	perchloroethylene	13
7211	---	perchloroethylene	13
7213	---	perchloroethylene	13
7215	---	perchloroethylene	10
7216	4 01 001 99 4 01 002 02	methyl chloroform, trichloroethylene, perchloroethylene, ethylene dichloride, toluene	1, 2, 5, 6, 8, 13
7218	---	perchloroethylene	10
7219	---	perchloroethylene	13
7221	---	ammonia	13
7291	---	perchloroethylene	13
7332	---	ammonia	13
7333	---	ammonia	13
7372	---	trichloroethylene	13
7391	---	trichloroethylene, mercury, ammonia, cadmium, chromium, copper, hydrogen chloride, formaldehyde, lead, hydrogen sulfide, manganese, methyl chloroform, methylene chloride, nickel, phosgene, phthalic anhydride, styrene, toluene, perchloroethylene, trichloroethylene, zinc/zinc oxide	1, 2, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
7392	---	ammonia, hydrogen chloride	13
7394	---	toluene	13
7395	---	methyl chloroform, methylene chloride	2, 13
7397	---	epichlorohydrin, hydrogen sulfide	13
7399	---	perchloroethylene, toluene, benzene, methyl chloroform, trichloroethylene	1, 2,
7461	---	hydrogen chloride, methylene chloride	13
7499	---	toluene	13
7512	---	toluene	13
7531	---	naphthalene, toluene	13
7534	---	toluene	13
7535	---	toluene, xylene, naphthalene, zinc oxide, benzene	12, 13
7538	---	methyl chloroform, toluene	13
7539	---	ammonia, asbestos, formaldehyde, toluene	13
7541	---	toluene	13
7629	---	toluene	13
7641	---	ammonia, lead, methylene chloride, toluene, xylene	13
7694	---	copper, hydrogen chloride, toluene, naphthalene	13
7699	---	arsenic, copper, ammonia, toluene, chlorine/HCl, xylene	4, 13
7716	---	perchloroethylene	13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
7819	---	formaldehyde, methyl chloroform	13
7869	---	hydrogen chloride, phosgene, phthalic anhydride	13
7941	---	lead	13
7999	---	ethylene oxide	13
8021	---	mercury	1
8061	---	ethylene oxide	13
8062	---	phenol, ethylene oxide, styrene, hydrogen chloride, hydrogen sulfide	2, 13
8063	---	methylene chloride	13
8069	---	ethylene oxide	4
8071	---	ethylene oxide	4
8091	---	ethylene oxide	13
8211	---	phenol, lead, toluene, xylene	2, 13
8220	---	toluene	13
8222	---	methyl chloroform	6
8244	---	toluene	13
8249	---	toluene	13
8411	---	toluene	13
8910	---	ammonia	13
8922	---	ammonia, methyl chloroform	13
8931	---	ammonia	13
8999	---	copper, styrene, toluene	10, 13

TABLE C-1. Continued

SIC Code	SCC Code[a]	Potential Pollutant	Reference (page C-50)
9111	---	ammonia, chlorine	13
9189	---	benzene, perchloroethylene, methyl chloroform, trichloroethylene	13
9199	---	ammonia	13
9349	---	benzene, methyl chloroform, toluene, perchloroethylene, trichloroethylene, vinyl chloride	13
9511	---	benzene, hydrogen sulfide, mercury, methylene chloride, chlorobenzene, toluene, trichloroethylene, xylene	13
9711	---	trichloroethylene, methylene chloride, xylene, methyl chloroform, toluene, phenol, beryllium, cadmium, benzene, chromium, ethylene oxide, manganese, formaldehyde, lead, PAH, gasoline vapors, nickel, POM, ammonia, radionuclides, chlorine/HCl, hydrogen sulfide, methylene chloride, chlorinated phenols, perchloroethylene	1, 2, 5, 10 13

APPENDIX C REFERENCES

1. KVB. Airborne Toxic Materials Study for Sacramento County. July 1983.
2. Santa Barbara County APCD. Santa Barbara County 1983 Toxics Emissions Inventory. November 1983.
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APPENDIX D

POLLUTANT/SIC INDEX

APPENDIX D
POLLUTANT/SIC INDEX

This table shows, by pollutant, the Standard Industrial Classification (SIC) codes of source categories that potentially emit each pollutant. The material here is identical to that found in Appendix C and was obtained from the same data sources, but is presented in a different format. The Chemical Abstracts Services (CAS) number, a unique substance identification number, is also shown.

The data presented here are potential or likely associations between pollutant and source category (by SIC). Every source may not emit all of the pollutants shown with its SIC code. Also, the data do not have any bearing on the quantity of pollutant emitted. Pollutants may be emitted in trace amounts or in tons per year.

Pollutant	CAS No.	SIC Code				Reference (pg. D-19)
Acetaldehyde	75-7-0	2013	2821	2892	3832	1, 4, 5, 13
		2095	2844	2911	3861	
		2099	2851	3079	4911	
		2421	2865	3321	6512	
		2643	2869	3479		
		2654	2879	3679		
Acrolein	107-02-8	2048	2821	2869	3321	1, 3, 4, 13
		2095	2844	2879	3471	
Acrylonitrile	107-13-1	2211	2821	2865	3861	1, 4, 5, 11,
		2221	2822	2869	3942	
		2252	2824	2879		
		2261	2833	3079		
		2269	2834	3499		
Allyl chloride	107-5-1	2822				4, 13
		2834				
		2869				
		3675				
Ammonia	7664-41-7	0289	2834	3433	3729	1, 12, 13
		0723	2840	3442	3742	
		0724	2841	3444	3743	
		1031	2842	3446	3769	
		1094	2844	3449	3811	
		1311	2851	3465	3821	
		1321	2865	3471	3829	
		1950	2869	3479	3831	
		1951	2872	3484	3840	
		2013	2873	3496	3842	
		2023	2874	3497	3843	
		2036	2875	3499	3851	
		2080	2879	3511	3861	
		2253	2891	3519	3911	
		2282	2892	3535	3914	
		2294	2893	3536	3915	
		2311	2895	3541	3961	
		2321	2899	3542	3993	
		2328	2911	3551	3999	
		2335	2951	3554	4226	
		2339	3011	3555	4742	
		2361	3069	3559	4939	
		2371	3079	3561	4952	
		2387	3126	3568	4953	
		2396	3200	3569	5086	
		2432	3211	3572	5093	
		2511	3220	3573	5094	
		2522	3231	3585	5096	
		2531	3264	3592	5153	
		2541	3272	3599	5161	
		2545	3291	3610	5191	

Pollutant	CAS No.	SIC Code				Reference
(Ammonia continued)		2621	3293	3611	5712	
		2641	3296	3612	6512	
		2643	3297	3613	6513	
		2649	3312	3621	6514	
		2653	3312	3622	7221	
		2654	3315	3629	7332	
		2655	3317	3641	7333	
		2661	3321	3642	7391	
		2751	3322	3643	7392	
		2752	3325	3645	7539	
		2754	3339	3651	7641	
		2782	3341	3661	7699	
		2791	3356	3662	8910	
		2800	3361	3670	8922	
		2812	3362	3673	8931	
		2815	3369	3674	9111	
		2816	3398	3679	9199	
		2818	3399	3711		
		2819	3400	3714		
		2821	3423	3717		
		2823	3429	3721		
		2833	3432	3728		
Arsenic	7440-38-2	0724	2253	2851	3332	1, 4, 5, 6, 7, 10, 13
		1021	2271	2861	3339	
		1031	2279	2865	3341	
		1059	2283	2869	3471	
		1081	2291	2879	3479	
		1111	2295	2891	3484	
		1112	2335	2892	3551	
		1213	2352	2893	3559	
		1446	2396	2899	3569	
		1453	2491	2911	3573	
		1477	2621	3200	3574	
		1481	2641	3211	3582	
		1499	2731	3221	3620	
		1629	2812	3229	3674	
		1711	2813	3241	3679	
		1721	2816	3251	3811	
		1799	2819	3253	3861	
		2011	2821	3299	3999	
		2013	2823	3312	4911	
		2033	2831	3313	4941	
		2086	2833	3321	4952	
		2091	2834	3325	4953	
		2097	2842	3331	7699	
Asbestos	1332-21-4	1499	2821	3273	3811	5, 6, 13
		2261	2851	3292	3861	
		2296	2869	3293	4111	
		2431	2891	3573	5013	
		2661	2951	3714	5093	

Pollutant	CAS No.	SIC Code				Reference
(Asbestos continued)		2810	2952	3717	7539	
	-	2812	2992	3731		
Benzene	71-43-2	0289	2296	2893	3573	1, 3, 4, 5, 9
		1041	2396	2899	3579	
		1382	2591	2911	3662	
		1721	2751	2921	3673	
		1781	2752	2951	3714	
		1799	2753	2992	3833	
		2023	2754	3011	3834	
		2032	2810	3031	3861	
		2051	2812	3069	3996	
		2065	2818	3079	4226	
		2099	2819	3194	4922	
		2111	2821	3292	4959	
		2141	2822	3312	4961	
		2211	2823	3321	5161	
		2221	2831	3361	5171	
		2231	2841	3411	5172	
		2241	2842	3433	5194	
		2252	2843	3449	5541	
		2253	2844	3461	7359	
		2261	2851	3471	7535	
		2262	2861	3479	9189	
		2269	2865	3519	9349	
		2272	2869	3542	9511	
		2293	2879	3559	9711	
		2295	2891	3572		
Benzidine	92-87-5	2099	2865			4, 13
		2251	3573			
		2269	3861			
Benzo(a)pyrene See also POM, PAH	50-32-8	1612	2895	2951	3624	5, 13
		26	2911	3312	3629	
		2861	2921	3573	4911	
Benzyl chloride	100-44-7	2819	3844	3079	5171	1, 3, 4, 5, 1
		2834	2865	3679		
		2843	2869	3861		
Beryllium	7440-41-7	1099	3253	3634	3822	1, 3, 4, 5, 1
		1446	3255	3659	3823	
		1453	3264	3672	3825	
		1499	3297	3673	3914	
		1629	3312	3674	3993	
		2063	3321	3679	4899	
		2813	3369	3691	4911	
		2911	3545	3693	4953	
		3079	3572	3694	9711	
		3251	3612	3811		

Pollutant	CAS No.	SIC Code				Reference
Bis(chloromethyl) ether	542-89-1	22	3573			5, 13
		28	3861			
1,3-Butadiene	106-99-0	2269	2822	2879		5, 13
		2812	2827	4226		
		2821	2869	5161		
Cadmium	7440-43-9	1021	2911	3341	3711	1, 4, 5, 6, 7, 13
		1031	3031	3351	3714	
		1499	3200	3432	3811	
		2387	3211	3442	3823	
		2512	3229	3452	3843	
		2621	3241	3471	3861	
		2631	3291	3479	4911	
		2819	3313	3499	4952	
		2821	3321	3536	4953	
		2826	3324	3547	6512	
		2873	3325	3572	7391	
		2874	3331	3641	9711	
		2879	3332	3673		
		2893	3333	3679		
		2899	3339	3692		
Carbon tetrachloride	56-23-5	0289	2813	2851	3531	1, 3, 4, 6, 1
		1382	2818	2865	3674	
		2079	2821	2869	3861	
		2431	2822	2879	5171	
		2800	2833	2952		
		2810	2834	3296		
		2812	2842	3461		
Chlorobenzene	108-90-7	2865	1382	3362	3861	3, 4, 5, 13
		2869	2812	3555		
		2879	2818	3662		
		0289	3203	3674		
Chloroethane	75-00-3	2821				10, 13
		2869				
Chloroform	67-66-3	0289	2522	2816	3573	3, 5, 6, 13
		2013	2611	2822	3679	
		2099	2621	2834	3821	
		2111	2631	2842	3861	
		2221	2800	2865	4959	
		2511	2810	2869	9711	
		2521	2812	2879		
Chlorine/HCl	7782-50-5	0723	2840	3339	3679	10, 12, 13
	7647-01-0	2046	2842	3341	3711	
		2399	2860	3352	3714	
		2408	2865	3354	3822	
		2611	2869	3361	3843	

Pollutant	CAS No.	SIC Code				Reference
(Chlorine/HCL continued)		2621	2879	3369	3861	
		2810	2899	3429	3951	
		2812	2911	3471	3961	
		2818	3069	3499	4953	
		2819	3079	3553	5171	
		2821	3229	3573	7699	
		2822	3295	3624	9111	
		2823	3312	3662		
		2834	3334	3674		
Chloroprene	126-99-8	2821				5
		2822				
Chromium	7440-47-3	1499	3255	3423	3713	1, 3, 4, 5, 7, 13
		2261	3271	3429	3714	
		2491	3272	3433	3721	
		2816	3291	3471	3743	
		2819	3292	3477	3811	
		2834	3295	3479	3821	
		2851	3297	3481	3831	
		2861	3312	3533	3842	
		2865	3313	3545	3861	
		2869	3321	3547	4231	
		2899	3324	3548	4911	
		2911	3325	3555	4941	
		2951	3331	3559	4952	
		2952	3332	3569	4953	
		2999	3341	3573	5093	
		3111	3350	3673	6512	
		3211	3362	3675	7391	
		3229	3399	3679	9711	
		3241	3421	3711		
Coke oven emissions		2911				10
		3312				
Copper	7440-50-8	1021	3295	3471	3673	10, 12, 13
		1761	3299	3479	3679	
		2262	3313	3494	3699	
		2387	3321	3536	3714	
		2491	3325	3549	3811	
		2512	3331	3559	3821	
		2800	3339	3562	3952	
		2810	3341	3564	4131	
		2819	3351	3567	4911	
		2824	3360	3568	4931	
		2851	3361	3569	4952	
		2879	3362	3573	4953	
		2893	3369	3585	5093	
		2899	3425	3629	6573	
		3111	3429	3643	7391	
		3220	3441	3644	7694	

Pollutant	CAS No.	SIC Code				Reference
(Copper continued)		3241	3443	3661	7699	
		3264	3446	3662	8999	
		3292	3469	3670		
Cresol	1319-77-3	2295	2800	2851	3357	4, 13
		2491	2821	2865	3569	
		2514	2842	2879		
Dibenzofurans		2491				10
		2865				
1,4-Dichlorobenzene	106-46-7	2261	2865			4, 5
		2834	2879			
		2842				
3,3-Dichlorobenzidine	91-94-1	2822				4, 13
		2865				
Dimethyl sulfate	77-78-1	2099	2844			1, 5, 13
		2816	2865			
		2824	3861			
1,4-Dioxane	123-91-1	2211	2262	2843	2891	1, 4, 8, 13
		2221	2816	2844	3842	
		2231	2834	2851	3861	
		2241	2842	2865		
Epichlorohydrin	106-89-8	2099	2842	3569	7397	1, 4, 5, 13
		2821	2851	3675		
		2822	2869	3679		
		2834	2992	3861		
Ethylene dibromide	106-93-4	0723	2911			3, 4, 5, 13
		2834	3519			
		2869	5171			
		2879	5172			
Ethylene dichloride	107-06-2	0289	2822	2865	4226	1, 4, 5, 6, 8, 13
		1382	2823	2869	4463	
		2070	2824	2879	4959	
		2075	2831	2911	5171	
		2221	2833	3079	5541	
		23	2834	3679	7216	
		2821	2841	3861		
Ethylene oxide	75-21-8	2099	2869	3841	8061	2, 4, 6, 13
		2800	2879	3842	8062	
		2813	3069	3843	8069	
		2821	3079	6324	8071	
		2834	3829	7999	8091	
		2841	3831	8060	9711	

Pollutant	CAS No.	SIC Code				Reference
Formaldehyde	50-00-0	0289	2641	3761	3964	1, 3, 4, 5, 6, 8, 13
		1311	2643	3810	4111	
		2011	2649	4911	3471	
		2013	2651	9711	3484	
		2023	2754	3585	3499	
		2032	2800	3592	3511	
		2051	2812	3599	3544	
		2065	2819	3613	3544	
		2111	2821	3621	3561	
		2221	2833	4961	3565	
		2231	2834	2991	3569	
		2269	2841	2992	5013	
		2272	2842	3069	5171	
		2421	2844	3291	6512	
		2431	2851	3292	7391	
		2432	2861	3296	7539	
		2435	2865	3297	7819	
		2451	2869	3312	4711	
		2631	2892	3321	3642	
		2080	2893	3322	3643	
		2099	2899	3361	3661	
		2262	2911	3362	3662	
		2294	2921	3400	3679	
		2295	2951	3432	3711	
		2296	2952	3433	3714	
		2408	3079	3442	3821	
		2490	3111	3843	3841	
		2499	3229	3861	3842	
		2521	3572	3952		
		2522	3573	3963		
Freon 113	75-69-4	2844	3600	3585	3911	5, 10, 13
		2869	3800	3662		
		3499	0289	3579		
		35	3484	3831		
Gasoline vapors	8006-61-9	1094	3519	4613	3079	6, 10, 13
		1311	3564	5092	3272	
		1380	5172	5171	3293	
		1501	5541	2754	3295	
		1791	9711	2818	3443	
		1799	3670	2821		
		2911	3679	2865		
		2999	4226	2869		
Hexachlorobenzene	118-74-1	2865				3, 4, 5
		2869				
		2879				
Hexachlorocyclopentadiene	77-47-4	2869				5, 10, 11, 13
		2879				
		2899				

Pollutant	CAS No.	SIC Code				Reference
Hydrazine	302-01-2	2262	2818	2879	3645	1, 3, 4, 5, 13
	-	2269	2834	2899	3670	
		2499	2865	3499	3761	
		2816	2869	3519	3861	
Hydrogen sulfide	7783-06-4	0723	2841	9711	3629	5, 13
		1094	2865	2992	3643	
		1211	2869	3079	3662	
		1311	2873	3264	3670	
		1321	2874	3273	3673	
		1381	2875	3292	3674	
		1382	2899	3312	3679	
		1389	2911	3321	3714	
		1477	4941	3341	3721	
		1799	4952	3429	3728	
		2091	5171	3462	3861	
		2611	5172	3471	3911	
		2621	6513	3483	4612	
		2641	7391	3569	4922	
		2818	7397	3573	4925	
		2819	8062	3585	4932	
		2821	9511	3624		
Lead	7439-92-1	0291	2911	3425	3573	1, 3, 4, 5, 6, 7, 13
		1446	3031	3429	3583	
		1453	3069	3443	3611	
		1711	3079	3466	3612	
		1721	3111	3471	3620	
		1741	3194	3479	3621	
		1761	3200	3482	3642	
		1799	3229	3484	3662	
		2282	3241	3497	3670	
		2295	3251	3499	3691	
		2421	3253	3533	3692	
		2512	3264	3536	3811	
		2731	3269	3541	2821	
		2732	3291	3542	3823	
		2794	3293	3555	3842	
		2800	3312	3559	3561	
		2816	3321	3561	3911	
		2819	3325	3564	3914	
		2821	3332	3567	3915	
		2822	3333	3569	4469	
		2831	3339	3672	4952	
		2833	3341	3673	4953	
		2834	3351	3674	6512	
		2851	3355	3675	9711	
		2873	3356	3679	7391	
		2879	3362	3699	7641	
		2891	3369	3714	7941	
		2892	3398	3717	8211	

Pollutant	CAS No.	SIC Code				Reference
(Lead continued)		2893	3411	3721		
		2899	3421	3769		
Maleic anhydride	108-31-6	2099	2869			4, 5, 13
		2821	2879			
		2822	2899			
		2865	2911			
Manganese	7439-96-5	3291	3399	3691	4953	4, 5, 13
		3313	3643	3714	6514	
		3321	3679	4911	9711	
Mercury	7439-97-6	1021	2879	3332	3829	1, 3, 4, 5, 13
		1031	2892	3333	3861	
		1092	2911	3499	4091	
		2812	3079	3611	4911	
		2813	3200	3629	4941	
		2819	3241	3641	4952	
		2821	3274	3642	4953	
		2833	3229	3674	8021	
		2834	3241	3679	9511	
		2851	3312	3821		
		2869	3331	3822		
Methyl bromide	74-83-9	2011	2865			1, 13
		2048	2879			
		2299	3264			
		2833				
Methyl chloride	74-87-3	2818	2879			8, 13
		2821	2899			
		2869	3315			
		3679				
Methyl chloroform	71-55-6	0289	3199	3555	3714	1, 2, 3, 4, 5, 6, 13
		1382	3200	3559	3721	
		1781	3208	3561	3728	
		1950	3229	3562	3742	
		1951	3269	3564	3800	
		2013	3291	3566	3811	
		2111	3292	3567	3821	
		2291	3300	3573	3822	
		2298	3321	3573	3825	
		2329	3323	3574	3831	
		2434	3325	3585	3832	
		2511	3361	3585	3841	
		2521	3362	3599	3842	
		2522	3411	3611	3843	
		2542	3412	3612	3851	
		2591	3421	3613	3861	
		2641	3423	3613	3911	
		2643	3429	3619	3941	

Pollutant	CAS No.	SIC Code				Reference
(Methyl Chloroform continued)		2732	3442	3621	3943	
		2750	3443	3621	3993	
		2754	3444	3622	4742	
		2782	3446	3629	4931	
		2800	3451	3631	4941	
		2810	3452	3636	4959	
		2819	3461	3641	5712	
		2821	3469	3642	6512	
		2831	3471	3643	6513	
		2834	3479	3645	6514	
		2842	3493	3646	7216	
		2844	3494	3651	7391	
		2851	3496	3661	7395	
		2851	3499	3661	7538	
		2869	3500	3662	7819	
		2891	3511	3670	8222	
		2951	3519	3674	8922	
		2992	3533	3675	9182	
		3011	3542	3679	9349	
		3021	3544	3691	9711	
		3069	3545	3694		
		3079	3551	3699		
Methyl isocyanate	624-83-9	2099	2899			10, 13
		2865	2951			
		2869	3029			
		2879				
Methyl methacrylate	80-62-6	2821	2841	2899	5171	
		2833	2851	3079		
		2834	2869	4226		
Methylene chloride	75-09-2	0289	2865	3551	3799	2, 3, 4, 5,
		2070	2869	3555	3811	6, 8, 13
		2095	2870	3573	3831	
		2099	2879	3573	3832	
		2111	2891	3579	3861	
		2431	3011	3585	3861	
		2434	3069	3599	3900	
		2499	3079	3600	3911	
		25	3221	3612	3951	
		2511	3229	3643	3999	
		2521	3291	3661	4226	
		2522	3316	3662	4463	
		2542	3362	3670	4959	
		2599	3411	3674	5161	
		2643	3423	3675	5712	
		2751	3429	3679	6513	
		2754	3431	3700	7391	
		2800	3452	3711	7395	
		2818	3461	3713	7461	
		2821	3465	3714	7641	

Pollutant	CAS No.	SIC Code				Reference
(Methylene Chloride continued)		2822	3471	3721	8063	
		2833	3479	3722	9511	
		2834	3499	3728	9711	
		2842	3544	3742		
		2844	3545	3769		
Mineral fibers		2221	3297			10
		2241	3296			
		3255	3299			
Naphthalene	91-20-3	0299	2861	3312	3642	10, 12, 13
		0851	2865	3321	3679	
		2392	2869	3325	3692	
		2432	2911	3357	3714	
		2433	2999	3412	3831	
		2491	3021	3429	3861	
		2499	3031	3461	3993	
		2511	3069	3481	5078	
		2521	3079	3544	5111	
		2643	3111	3562	6512	
		2751	3264	3573	6513	
		2800	3292	3612	7531	
		2819	3300	3619	7535	
		2851	3312	3621		
Nickel	7440-02-2	1061	3241	3533	3713	1, 4, 5, 6, 7, 13
		1422	3312	3549	3721	
		2079	3313	3569	3722	
		2251	3321	3572	3743	
		2496	3325	3573	3831	
		2754	3331	3592	3842	
		2819	3332	3623	3861	
		2851	3339	3643	4131	
		2873	3341	3673	4911	
		2911	3356	3674	4952	
		3200	3425	3679	4953	
		3211	3471	3691	7391	
		3220	3479	3692	9711	
Nitrobenzene	98-95-3	2099	2851	2892		1, 3, 4, 5, 13
		2821	2865	3471		
		2842	2869	3573		
Nitrosomorpholine	59-89-2	2865				4
		2869				
		2891				
Perchloroethylene	127-18-4	0289	2869	3542	3949	1, 2, 3, 4, 5 6, 8, 13
		1216	2893	3554	3951	
		2000	2899	3559	3961	
		2111	3041	3561	3993	
		2216	3069	3566	4463	

Pollutant	CAS No.	SIC Code				Reference
(Perchloroethylene continued)		2221	3216	3573	4941	
		2231	3229	3582	4959	
		2253	3264	36	5191	
		2256	3291	3611	6512	
		2262	3317	3612	6513	
		2269	3325	3613	6514	
		2295	3369	3629	7210	
		2296	3400	3633	7212	
		2371	3411	3642	7213	
		2435	3437	3643	7215	
		2500	3442	3661	7215	
		2522	3443	3670	7216	
		2542	3444	3674	7216	
		2641	3446	3679	7218	
		2643	3446	3694	7218	
		2751	3461	3699	7219	
		2754	3465	37	7221	
		2754	3469	3714	7291	
		2810	3471	3721	7391	
		2819	3479	3728	7399	
		2821	3496	3761	7716	
		2822	3497	3811	9189	
		2834	3499	3841	9349	
		2841	3511	3861	9711	
		2842	3531	3900		
		2851	3540	3941		
Phenol/chlorinated phenols	108-95-2	0289	2865	3362	3642	2, 4, 5, 13
		1446	2869	3429	3643	
		2013	2879	3432	3670	
		2099	2892	3433	3674	
		22	2911	3484	3679	
		2431	3011	3494	3711	
		2491	3079	3511	3811	
		2499	3291	3561	3843	
		2800	3296	3565	3861	
		2819	3297	3569	4226	
		2821	3312	3573	6512	
		2833	3321	3599	8062	
		2834	3325	3612	8211	
		2851	3361	3621	9711	
Phosgene	75-44-5	2812	2834	3334	7869	4, 5, 13
		2815	2865	3679		
		2818	2869	3861		
		2819	2879	7391		
Phthalic anhydride	85-44-9	2599	2851	3079	7391	10, 12, 13
		2821	2865	3511	7869	
		2821	2879	3585		
Polychlorinated biphenyl - PCB		2812	3629			1, 4, 13

Pollutant	CAS No.	SIC Code				Reference
(Polychlorinated buphenyl - PCB continued)		3315	4911			
		3612				
Polycyclic aromatic hydrocarbons - PAH		1612	2861	2911	4911	4
		2421	2865	2952	4953	
		26	2895	3312	9711	
Polycyclic organic matter - POM		1111	2865	2952	9711	5
		2421	2869	3312		
		26	2911	4911		
		2861	2951	4953		
Propylene oxide	75-56-9	2821	3411			4, 13
		2843	3585			
		2869	3861			
Radionuclides		1094	4511			4, 5
		1475	9711			
		2819				
Styrene	100-42-5	1711	2869	3423	3861	5, 13
		1743	3011	3443	3941	
		2221	3069	3499	3944	
		2295	3079	3511	3949	
		2434	3079	3621	3963	
		2511	3229	3622	3999	
		2522	3261	3624	4226	
		2821	3271	3661	5161	
		2821	3291	3670	5171	
		2822	3299	3673	6512	
		2822	3321	3674	6514	
		2833	3325	3679	7391	
		2834	3341	3713	8062	
		2851	3361	3721	8999	
		2865	3369	3732		
Tetrahydrofuran	109-99-9	2821	3300	3573	3842	5, 13
		2865	3443	3670	3861	
		3079	3544	3679	5171	
Toluene	108-88-3	0282	2833	3490	3831	1, 4, 6, 8
		0289	2834	3492	3832	
		0373	2834	3493	3840	
		1382	2841	3494	3841	
		1616	2842	3496	3842	
		1629	2843	3499	3843	
		1721	2844	3499	3861	
		1781	2851	3511	3861	
		1791	2851	3522	3871	
		1799	2860	3523	3900	
		1950	2865	3531	3911	
		2000	2865	3534	3931	

Pollutant	CAS No.	SIC Code				Reference
(Toluene continued)		2013	2869	3535	3941	
		2023	2869	3537	3942	
		2032	2891	3541	3944	
		2033	2891	3542	3949	
		2051	2892	3544	3951	
		2052	2893	3545	3952	
		2065	2893	3548	3953	
		2079	2899	3549	3955	
		2086	2911	3551	3961	
		2111	2911	3552	3962	
		2190	2921	3553	3963	
		2261	2951	3554	3964	
		2269	2951	3555	3993	
		2295	2992	3559	3995	
		2296	3011	3561	3999	
		2369	3021	3562	4111	
		2387	3031	3563	4131	
		2389	3041	3564	4212	
		2392	3041	3566	4226	
		2396	3060	3567	4231	
		2411	3069	3569	4463	
		2421	3079	3572	4582	
		2423	3079	3572	4742	
		2426	3111	3573	4782	
		2431	3141	3579	4811	
		2431	3143	3581	4922	
		2431	3172	3582	4923	
		2432	3199	3585	4953	
		2434	3200	3585	5021	
		2434	3211	3586	5042	
		2449	3220	3589	5078	
		2479	3229	3599	5081	
		2490	3231	3610	5084	
		2491	3241	3611	5113	
		2499	3261	3612	5161	
		2511	3263	3613	5171	
		2511	3264	3620	5171	
		2512	3272	3621	5172	
		2514	3291	3622	5194	
		2514	3293	3623	5211	
		2517	3299	3629	5212	
		2519	3312	3632	5341	
		2521	3312	3633	5511	
		2521	3315	3634	5541	
		2522	3316	3636	5541	
		2522	3321	3641	5551	
		2531	3325	3642	5599	
		2541	3352	3643	5710	
		2542	3357	3644	5712	
		2599	3361	3645	5984	
		2621	3362	3648	5999	
		2631	3369	3651	6499	

Pollutant	CAS No.	SIC Code				Reference
(Toluene continued)		2641	3391	3651	6512	
		2641	3400	3661	6513	
		2643	3411	3661	6514	
		2644	3411	3662	7216	
		2645	3412	3670	7391	
		2649	3421	3673	7394	
		2652	3425	3674	7399	
		2654	3429	3679	7499	
		2655	3431	3693	7512	
		2700	3432	3694	7531	
		2741	3433	3699	7534	
		2750	3440	3710	7535	
		2751	3441	3711	7538	
		2752	3442	3713	7539	
		2754	3442	3714	7541	
		2754	3443	3717	7629	
		2782	3446	3721	7641	
		2789	3447	3728	7694	
		2800	3448	3729	7699	
		2810	3448	3742	8211	
		2812	3449	3751	8220	
		2815	3461	3761	8244	
		2818	3465	3769	8249	
		2819	3469	3799	8411	
		2819	3470	3800	8999	
		2821	3471	3811	9349	
		2821	3479	3821	9511	
		2822	3481	3823	9711	
		2822	3483	3825	9711	
		2833	3484	3829		
Toluene diisocyanate	584-84-9	1081	2282	2869	3662	1, 10, 13
		1112	2521	3069	3670	
		1213	2541	3069	3674	
		1446	2800	3079	3679	
		1453	2821	3079	3714	
		1481	2822	3291	3743	
		1629	2824	3444	3821	
		1799	2851	3511		
		2221	2861	3555		
		2281	2865	3643		
Trichloroethylene	79-01-6	0289	3126	3567	3821	1, 2, 3, 4, 6, 13
		37	3172	3569	3822	
		39	3200	3573	3831	
		1721	3208	3585	3832	
		1781	3231	3599	3832	
		1950	3264	3600	3840	
		1951	3281	3611	3841	
		2099	3293	3612	3851	
		2425	3312	3613	3861	
		2429	3362	3619	3873	

Pollutant	CAS No.	SIC Code				Reference
(Trichloroethylene continued)		2432	3369	3621	3911	
		2500	3398	3622	3914	
		2511	3400	3629	3931	
		2514	3411	3631	3951	
		2521	3421	3641	3953	
		2522	3423	3642	3961	
		2541	3442	3643	3963	
		2542	3443	3644	3964	
		2599	3444	3645	3993	
		2621	3446	3648	3999	
		2645	3451	3651	4463	
		2653	3452	3661	4941	
		2711	3461	3662	4941	
		2751	3469	3670	4959	
		2752	3471	3673	5531	
		2754	3479	3674	6512	
		2782	3481	3674	6513	
		2810	3483	3675	6514	
		2812	3494	3679	7216	
		2819	3499	3693	7372	
		2819	3535	3699	7391	
		2842	3541	3714	7391	
		2844	3542	3717	7399	
		2851	3544	3721	9189	
		2865	3545	3722	9349	
		2869	3552	3728	9511	
		2899	3554	3761	9711	
		2992	3559	3764		
		3069	3564	3811		
Vinyl chloride	75-01-4	1442	2879	3573	4959	4, 5, 8, 13
		2269	2893	3612	5161	
		2396	3029	3644	6512	
		2799	3069	3699	6513	
		2812	3079	3861	6514	
		2821	3300	3899		
		2865	3357	4941		
		2869	3496	4953		
Vinylidene chloride	75-35-4	0289	2821	2834	3861	4, 5, 13
		2269	2822	2869		
		2295	2824	3642		
		2812	2833	3842		
Xylene	1330-20-7	1382	2869	3448	3721	1, 4, 6, 8, 13
		1629	2879	3479	3761	
		1781	2891	3511	3861	
		2269	2893	3533	3861	
		2295	2899	3552	4463	
		2431	2911	3572	4742	
		2434	2992	3585	5171	
		2511	3231	3612	5194	

Pollutant	CAS No.	SIC Code				Reference
(Xylene continued)		2514	3264	3642	5541	
		2521	3291	3651	6512	
		2522	3292	3661	7535	
		2531	3312	3662	7641	
		2754	3321	3662	7699	
		2821	3325	3673	9511	
		2834	3411	3674	9711	
		2851	3441	3679		
		2865	3442	3699		
Zinc/zinc oxide	1314-13-2	1031	3300	3484	3693	1, 10, 12, 13
		1951	3300	3494	3714	
		2387	3312	3494	3714	
		2522	3315	3497	3717	
		2646	3321	3499	3721	
		2699	3322	3536	3728	
		2816	3325	3544	3811	
		2818	3331	3547	3823	
		2819	3332	3549	3841	
		2834	3333	3551	3843	
		2842	3339	3555	3861	
		2843	3341	3567	3861	
		2844	3351	3569	3953	
		2851	3355	3573	3964	
		2864	3356	3573	3993	
		2879	3360	3585	3999	
		2893	3361	3612	3999	
		2899	3362	3642	4952	
		2911	3369	3643	4953	
		3011	3369	3644	5052	
		3069	3423	3662	6512	
		3079	3425	3670	6513	
		3241	3429	3674	6513	
		3264	3442	3679	7391	
		3272	3452	3679	7535	
		3291	3471	3691		
		3293	3471	3692		
		3297	3479	3692		

APPENDIX E

SIC CODE DESCRIPTORS

APPENDIX E

SIC CODE DESCRIPTORS

The descriptions of all two, three, and four digit Standard Industrial Classification (SIC) Codes are listed in this Appendix. Descriptions were obtained from the Standard Industrial Classification Code Manual, available from the U. S. Government Printing Office, Washington, D.C.

Two digit SIC codes represent the broadest classification of industry type. For example, SIC 28 represents the chemical and allied products industry. A three digit code specifies a slightly more detailed classification. Thus, SIC 287 represents the chemical and allied products industry, specifically the agricultural chemicals group. Finally, a four digit SIC code represents the most detailed SIC classification. For example, SIC 2874 represents phosphatic fertilizer manufacture.

SIC Code	Description
A	Agriculture, forestry, and fishing
01	Agricultural production-crops
011	Cash grains
0111	Wheat
0112	Rice
0115	Corn
0116	Soybeans
0119	Cash grains, nec
013	Field crops, except cash grains
0131	Cotton
0132	Tobacco
0133	Sugar crops
0134	Irish potatoes
0139	Field crops, except cash grains, nec
016	Vegetables and melons
0161	Vegetables and melons
017	Fruits and tree nuts
0171	Berry crops
0172	Grapes
0173	Tree nuts
0174	Citrus fruits
0175	Deciduous tree fruits
0179	Fruits and tree nuts, nec
018	Horticultural specialties
0181	Ornamental nursery products
0182	Food crops grown under cover
0189	Horticultural specialties, nec
019	General farms, primarily crop
0191	General farms, primarily crop
02	Agricultural production-livestock
021	Livestock, exc. dairy, poultry, etc.
0211	Beef cattle feedlots
0213	Hogs
0214	Sheep and goats
0212	Beef cattle, except feedlots
0219	General livestock, nec
024	Dairy farms
0241	Dairy farms
025	Poultry and eggs
0251	Broiler, fryer and roaster chickens
0252	Chicken eggs
0253	Turkeys and turkey eggs
0254	Poultry hatcheries
0259	Poultry & eggs, nec
027	Animal specialties
0271	Fur-bearing animals and rabbits
0272	Horses and other equines
0279	Animal specialties, nec
029	General farms, primarily livestock
0291	General farms, primarily livestock
07	Agricultural services
071	Soil preparation services
0711	Soil preparation services
072	Crop services
0721	Crop planting and protection
0722	Crop harvesting
0723	Crop preparation services for market
0724	Cotton ginning
0729	General crop services
074	Veterinary services
0741	Veterinary services, farm livestock
0742	Veterinary services, specialties
075	Animal services, except veterinary
0751	Livestock services, exc. specialties
0752	Animal specialty services
076	Farm labor and management services
0761	Farm labor contractors
0762	Farm management services
078	Landscape and horticultural services
0781	Landscape counseling and planning
0782	Lawn and garden services
0783	Ornamental shrub and tree services
08	Forestry
081	Timber tracts
0811	Timber tracts
082	Forest nurseries and seed gathering
0821	Forest nurseries and seed gathering
084	Gathering of misc. forest products
0843	Extraction of pine gum
0849	Gathering of forest products, nec
085	Forestry services
0851	Forestry services
09	Fishing, hunting, and trapping
091	Commercial fishing
0912	Finfish
0913	Shellfish
0919	Miscellaneous marine products
092	Fish hatcheries and preserves
0921	Fish hatcheries and preserves
097	Hunting, trapping, game propagation
0971	Hunting, trapping, game propagation
B	Mining
10	Metal mining
101	Iron ores
1011	Iron ores
102	Copper ores
1021	Copper ores
103	Lead and zinc ores
1031	Lead and zinc ores
104	Gold and silver ores
1041	Gold ores
1044	Silver ores
105	Bauxite and other aluminum ores
1051	Bauxite and other aluminum ores
106	Ferroalloy ores, except vanadium
1061	Ferroalloy ores, except vanadium
108	Metal mining services
1081	Metal mining services
109	Miscellaneous metal ores
1092	Mercury ores
1094	Uranium-radium-vanadium ores
1099	Metal ores, nec
11	Anthracite mining
111	Anthracite mining
1111	Anthracite
1112	Anthracite mining services
12	Bituminous coal and lignite mining
121	Bituminous coal and lignite mining
1211	Bituminous coal and lignite
1213	Bituminous & lignite mining services

13	Oil and gas extraction
131	Crude petroleum and natural gas
1311	Crude petroleum and natural gas
132	Natural gas liquids
1321	Natural gas liquids
138	Oil and gas field services
1381	Drilling oil and gas wells
1382	Oil and gas exploration services
1389	Oil and gas field services, nec
14	Nonmetallic minerals, except fuels
141	Dimension stone
1411	Dimension stone
142	Crushed and broken stone
1422	Crushed and broken limestone
1423	Crushed and broken granite
1429	Crushed and broken stone, nec
144	Sand and gravel
1442	Construction sand and gravel
1446	Industrial sand
145	Clay, ceramic & refractory minerals
1452	Bentonite
1453	Fire clay
1454	Fuller's earth
1455	Kaolin and ball clay
1459	Clay and related minerals, nec
147	Chemical and fertilizer minerals
1472	Barite
1473	Fluorspar
1474	Potash, soda, and borate minerals
1475	Phosphate rock
1476	Rock salt
1477	Sulfur
1479	Chemical and fertilizer mining, nec
148	Nonmetallic minerals services
1481	Nonmetallic minerals services
149	Miscellaneous nonmetallic minerals
1492	Gypsum
1496	Talc, soapstone, and pyrophyllite
1499	Nonmetallic minerals, nec
C	Construction
15	General building contractors
152	Residential building construction
1521	Single-family housing construction
1522	Residential construction, nec
153	Operative builders
1531	Operative builders
154	Nonresidential building construction
1541	Industrial buildings and warehouses
1542	Nonresidential construction, nec
16	Heavy construction contractors
161	Highway and street construction
1611	Highway and street construction
162	Heavy construction, except highway
1622	Bridge, tunnel, & elevated highway
1623	Water, sewer, and utility lines
1629	Heavy construction, nec
17	Special trade contractors
171	Plumbing, heating, air conditioning
1711	Plumbing, heating, air conditioning
172	Painting, paper hanging, decorating
1721	Painting, paper hanging, decorating
173	Electrical work
1731	Electrical work
174	Masonry, stonework, and plastering
1741	Masonry and other stonework
1742	Plastering, dry wall and insulation
1743	Terrazzo, tile, marble, mosaic work
175	Carpentering and flooring
1751	Carpentering
1752	Floor laying and floor work, nec
176	Roofing and sheet metal work
1761	Roofing and sheet metal work
177	Concrete work
1771	Concrete work
178	Water well drilling
1781	Water well drilling
179	Misc. special trade contractors
1791	Structural steel erection
1793	Glass and glazing work
1794	Excavating and foundation work
1795	Wrecking and demolition work
1796	Installing building equipment, nec
1799	Special trade contractors, nec
D	Manufacturing
20	Food and kindred products
201	Meat products
2011	Meat packing plants
2013	Sausages and other prepared meats
2016	Poultry dressing plants
2017	Poultry and egg processing
202	Dairy products
2021	Creamery butter
2022	Cheese, natural and processed
2023	Condensed and evaporated milk
2024	Ice cream and frozen desserts
2026	Fluid milk
203	Preserved fruits and vegetables
2032	Canned specialties
2033	Canned fruits and vegetables
2034	Dehydrated fruits, vegetables, soups
2035	Pickles, sauces, and salad dressings
2037	Frozen fruits and vegetables
2038	Frozen specialties
204	Grain mill products
2041	Flour and other grain mill products
2043	Cereal breakfast foods
2044	Rice milling
2045	Blended and prepared flour
2046	Wet corn milling
2047	Dog, cat, and other pet food
2048	Prepared feeds, nec
205	Bakery products
2051	Bread, cake, and related products
2052	Cookies and crackers
206	Sugar and confectionery products
2061	Raw cane sugar
2062	Cane sugar refining
2063	Beet sugar
2065	Confectionery products
2066	Chocolate and cocoa products

2067	Chewing gum
207	Fats and oils
2074	Cottonseed oil mills
2075	Soybean oil mills
2076	Vegetable oil mills, nec
2077	Animal and marine fats and oils
2079	Shortening and cooking oils
208	Beverages
2082	Malt beverages
2083	Malt
2084	Wines, brandy, and brandy spirits
2085	Distilled liquor, except brandy
2086	Bottled and canned soft drinks
2087	Flavoring extracts and sirups, nec
209	Misc. foods and kindred products
2091	Canned and cured seafoods
2092	Fresh or frozen packaged fish
2095	Roasted coffee
2097	Manufactured ice
2098	Macaroni and spaghetti
2099	Food preparations, nec
21	Tobacco manufactures
211	Cigarettes
2111	Cigarettes
212	Cigars
2121	Cigars
213	Chewing and smoking tobacco
2131	Chewing and smoking tobacco
214	Tobacco stemming and redrying
2141	Tobacco stemming and redrying
22	Textile mill products
221	Weaving mills, cotton
2211	Weaving mills, cotton
222	Weaving mills, synthetics
2221	Weaving mills, synthetics
223	Weaving and finishing mills, wool
2231	Weaving and finishing mills, wool
224	Narrow fabric mills
2241	Narrow fabric mills
225	Knitting mills
2251	Women's hosiery, except socks
2252	Hosiery, nec
2253	Knit outerwear mills
2254	Knit underwear mills
2257	Circular knit fabric mills
2258	Warp knit fabric mills
2259	Knitting mills, nec
226	Textile finishing, except wool
2261	Finishing plants, cotton
2262	Finishing plants, synthetics
2269	Finishing plants, nec
227	Floor covering mills
2271	Woven carpets and rugs
2272	Tufted carpets and rugs
2279	Carpets and rugs, nec
228	Yarn and thread mills
2281	Yarn mills, except wool
2282	Throwing and winding mills
2283	Wool yarn mills
2284	Thread mills
229	Miscellaneous textile goods
2291	Felt goods, exc. woven felts & hats
2292	Lace goods
2293	Paddings and upholstery filling
2294	Processed textile waste
2295	Coated fabrics, not rubberized
2296	Tire cord and fabric
2297	Nonwoven fabrics
2298	Cordage and twine
2299	Textile goods, nec
23	Apparel and other textile products
231	Men's and boys' suits and coats
2311	Men's and boys' suits and coats
232	Men's and boys' furnishings
2321	Men's and boys' shirts and nightwear
2322	Men's and boys' underwear
2323	Men's and boys' neckwear
2327	Men's and boys' separate trousers
2328	Men's and boys' work clothing
2329	Men's and boys' clothing, nec
233	Women's and misses' outerwear
2331	Women's & misses' blouses & waists
2335	Women's and misses' dresses
2337	Women's and misses' suits and coats
2339	Women's and misses' outerwear, nec
234	Women's and children's undergarments
2341	Women's and children's underwear
2342	Brassieres and allied garments
235	Hats, caps, and millinery
2351	Millinery
2352	Hats and caps, except millinery
236	Children's outerwear
2361	Children's dresses and blouses
2363	Children's coats and suits
2369	Children's outerwear, nec
237	Fur goods
2371	Fur goods
238	Miscellaneous apparel and accessories
2381	Fabric dress and work gloves
2384	Robes and dressing gowns
2385	Waterproof outergarments
2386	Leather and sheep lined clothing
2387	Apparel belts
2389	Apparel and accessories, nec
239	Misc. fabricated textile products
2391	Curtains and draperies
2392	House furnishings, nec
2393	Textile bags
2394	Canvas and related products
2395	Pleating and stitching
2396	Automotive and apparel trimmings
2397	Schiffli machine embroideries
2399	Fabricated textile products, nec
24	Lumber and wood products
241	Logging camps & logging contractors
2411	Logging camps & logging contractors
242	Sawmills and planing mills
2421	Sawmills and planing mills, general
2426	Hardwood dimension and flooring
2429	Special product sawmills, nec

243	Millwork, plywood & structural members
2431	Millwork
2434	Wood kitchen cabinets
2435	Hardwood veneer and plywood
2436	Softwood veneer and plywood
2439	Structural wood members, nec
244	Wood containers
2441	Nailed wood boxes and shook
2448	Wood pallets and skids
2449	Wood containers, nec
245	Wood buildings and mobile homes
2451	Mobile homes
2452	Prefabricated wood buildings
249	Miscellaneous wood products
2491	Wood preserving
2492	Particleboard
2499	Wood products, nec
25	Furniture and fixtures
251	Household furniture
2511	Wood household furniture
2512	Upholstered household furniture
2514	Metal household furniture
2515	Mattresses and bedsprings
2517	Wood tv and radio cabinets
2519	Household furniture, nec
252	Office furniture
2521	Wood office furniture
2522	Metal office furniture
253	Public building & related furniture
2531	Public building & related furniture
254	Partitions and fixtures
2541	Wood partitions and fixtures
2542	Metal partitions and fixtures
259	Miscellaneous furniture and fixtures
2591	Drapery hardware & blinds & shades
2599	Furniture and fixtures, nec
26	Paper and allied products
261	Pulp mills
2611	Pulp mills
262	Paper mills, except building paper
2621	Paper mills, except building paper
263	Paperboard mills
2631	Paperboard mills
264	Misc. converted paper products
2641	Paper coating and glazing
2642	Envelopes
2643	Bags, except textile bags
2645	Die-cut paper and board
2646	Pressed and molded pulp goods
2647	Sanitary paper products
2648	Stationery products
2649	Converted paper products, nec
265	Paperboard containers and boxes
2651	Folding paperboard boxes
2652	Set-up paperboard boxes
2653	Corrugated and solid fiber boxes
2654	Sanitary food containers
2655	Fiber cans, drums & similar products
266	Building paper and board mills
2661	Building paper and board mills
27	Printing and publishing
271	Newspapers
2711	Newspapers
272	Periodicals
2721	Periodicals
273	Books
2731	Book publishing
2732	Book printing
274	Miscellaneous publishing
2741	Miscellaneous publishing
275	Commercial printing
2751	Commercial printing, letterpress
2752	Commercial printing, lithographic
2753	Engraving and plate printing
2754	Commercial printing, gravure
276	Manifold business forms
2761	Manifold business forms
277	Greeting card publishing
2771	Greeting card publishing
278	Blankbooks and bookbinding
2782	Blankbooks and looseleaf binders
2789	Bookbinding and related work
279	Printing trade services
2791	Typesetting
2793	Photoengraving
2794	Electrotyping and stereotyping
2795	Lithographic platemaking services
28	Chemicals and allied products
281	Industrial inorganic chemicals
2812	Alkalies and chlorine
2813	Industrial gases
2816	Inorganic pigments
2819	Industrial inorganic chemicals, nec
282	Plastics materials and synthetics
2821	Plastics materials and resins
2822	Synthetic rubber
2823	Cellulosic man-made fibers
2824	Organic fibers, noncellulosic
283	Drugs
2831	Biological products
2833	Medicinals and botanicals
2834	Pharmaceutical preparations
284	Soap, cleaners, and toilet goods
2841	Soap and other detergents
2842	Polishes and sanitation goods
2843	Surface active agents
2844	Toilet preparations
285	Paints and allied products
2851	Paints and allied products
286	Industrial organic chemicals
2861	Gum and wood chemicals
2865	Cyclic crudes and intermediates
2869	Industrial organic chemicals, nec
287	Agricultural chemicals
2873	Nitrogenous fertilizers
2874	Phosphatic fertilizers
2875	F[illegible]ilizers, mixing only
2879	Agricultural chemicals, nec
289	Miscellaneous chemical products
2891	Adhesives and sealants

2892	Explosives
2893	Printing ink
2895	Carbon black
2899	Chemical preparations, nec
29	Petroleum and coal products
291	Petroleum refining
2911	Petroleum refining
295	Paving and roofing materials
2951	Paving mixtures and blocks
2952	Asphalt felts and coatings
299	Misc. petroleum and coal products
2992	Lubricating oils and greases
2999	Petroleum and coal products, nec
30	Rubber and misc. plastics products
301	Tires and inner tubes
3011	Tires and inner tubes
302	Rubber and plastics footwear
3021	Rubber and plastics footwear
303	Reclaimed rubber
3031	Reclaimed rubber
304	Rubber and plastics hose and belting
3041	Rubber and plastics hose and belting
306	Fabricated rubber products, nec
3069	Fabricated rubber products, nec
307	Miscellaneous plastics products
3079	Miscellaneous plastics products
31	Leather and leather products
311	Leather tanning and finishing
3111	Leather tanning and finishing
313	Footwear cut stock
3131	Footwear cut stock
314	Footwear, except rubber
3142	House slippers
3143	Men's footwear, except athletic
3144	Women's footwear, except athletic
3149	Footwear, except rubber, nec
315	Leather gloves and mittens
3151	Leather gloves and mittens
316	Luggage
3161	Luggage
317	Handbags and personal leather goods
3171	Women's handbags and purses
3172	Personal leather goods, nec
319	Leather goods, nec
3199	Leather goods, nec
32	Stone, clay, and glass products
321	Flat glass
3211	Flat glass
322	Glass and glassware, pressed or blown
3221	Glass containers
3229	Pressed and blown glass, nec
323	Products of purchased glass
3231	Products of purchased glass
324	Cement, hydraulic
3241	Cement, hydraulic
325	Structural clay products
3251	Brick and structural clay tile
3253	Ceramic wall and floor tile
3255	Clay refractories
3259	Structural clay products, nec
326	Pottery and related products
3261	Vitreous plumbing fixtures
3262	Vitreous china food utensils
3263	Fine earthenware food utensils
3264	Porcelain electrical supplies
3269	Pottery products, nec
327	Concrete, gypsum, and plaster products
3271	Concrete block and brick
3272	Concrete products, nec
3273	Ready-mixed concrete
3274	Lime
3275	Gypsum products
328	Cut stone and stone products
3281	Cut stone and stone products
329	Misc. nonmetallic mineral products
3291	Abrasive products
3292	Asbestos products
3293	Gaskets, packing and sealing devices
3295	Minerals, ground or treated
3296	Mineral wool
3297	Nonclay refractories
3299	Nonmetallic mineral products, nec
33	Primary metal industries
331	Blast furnace and basic steel products
3312	Blast furnaces and steel mills
3313	Electrometallurgical products
3315	Steel wire and related products
3316	Cold finishing of steel shapes
3317	Steel pipe and tubes
332	Iron and steel foundries
3321	Gray iron foundries
3322	Malleable iron foundries
3324	Steel investment foundries
3325	Steel foundries, nec
333	Primary nonferrous metals
3331	Primary copper
3332	Primary lead
3333	Primary zinc
3334	Primary aluminum
3339	Primary nonferrous metals, nec
334	Secondary nonferrous metals
3341	Secondary nonferrous metals
335	Nonferrous rolling and drawing
3351	Copper rolling and drawing
3353	Aluminum sheet, plate, and foil
3354	Aluminum extruded products
3355	Aluminum rolling and drawing, nec
3356	Nonferrous rolling and drawing, nec
3357	Nonferrous wire drawing & insulating
336	Nonferrous foundries
3361	Aluminum foundries
3362	Brass, bronze, and copper foundries
3369	Nonferrous foundries, nec
339	Miscellaneous primary metal products
3398	Metal heat treating
3399	Primary metal products, nec
34	Fabricated metal products
341	Metal cans and shipping containers
3411	Metal cans
3412	Metal barrels, drums, and pails

342	Cutlery, hand tools, and hardware
3421	Cutlery
3423	Hand and edge tools, nec
3425	Hand saws and saw blades
3429	Hardware, nec
343	Plumbing and heating, except electric
3431	Metal sanitary ware
3432	Plumbing fittings and brass goods
3433	Heating equipment, except electric
344	Fabricated structural metal products
3441	Fabricated structural metal
3442	Metal doors, sash, and trim
3443	Fabricated plate work (boiler shops)
3444	Sheet metal work
3446	Architectural metal work
3448	Prefabricated metal buildings
3449	Miscellaneous metal work
345	Screw machine products, bolts, etc.
3451	Screw machine products
3452	Bolts, nuts, rivets, and washers
346	Metal forgings and stampings
3462	Iron and steel forgings
3463	Nonferrous forgings
3465	Automotive stampings
3466	Crowns and closures
3469	Metal stampings, nec
347	Metal services, nec
3471	Plating and polishing
3479	Metal coating and allied services
348	Ordnance and accessories, nec
3482	Small arms ammunition
3483	Ammunition, exc. for small arms, nec
3484	Small arms
3489	Ordnance and accessories, nec
349	Misc. fabricated metal products
3493	Steel springs, except wire
3494	Valves and pipe fittings
3495	Wire springs
3496	Misc. fabricated wire products
3497	Metal foil and leaf
3498	Fabricated pipe and fittings
3499	Fabricated metal products, nec
35	Machinery, except electrical
351	Engines and turbines
3511	Turbines and turbine generator sets
3519	Internal combustion engines, nec
352	Farm and garden machinery
3523	Farm machinery and equipment
3524	Lawn and garden equipment
353	Construction and related machinery
3531	Construction machinery
3532	Mining machinery
3533	Oil field machinery
3534	Elevators and moving stairways
3535	Conveyors and conveying equipment
3536	Hoists, cranes, and monorails
3537	Industrial trucks and tractors
354	Metalworking machinery
3541	Machine tools, metal cutting types
3542	Machine tools, metal forming types
3544	Special dies, tools, jigs & fixtures
3545	Machine tool accessories
3546	Power driven hand tools
3547	Rolling mill machinery
3549	Metalworking machinery, nec
355	Special industry machinery
3551	Food products machinery
3552	Textile machinery
3553	Woodworking machinery
3554	Paper industries machinery
3555	Printing trades machinery
3559	Special industry machinery, nec
356	General industrial machinery
3561	Pumps and pumping equipment
3562	Ball and roller bearings
3563	Air and gas compressors
3564	Blowers and fans
3565	Industrial patterns
3566	Speed changers, drives, and gears
3567	Industrial furnaces and ovens
3568	Power transmission equipment, nec
3569	General industrial machinery, nec
357	Office and computing machines
3572	Typewriters
3573	Electronic computing equipment
3574	Calculating and accounting machines
3576	Scales and balances, exc. laboratory
3579	Office machines, nec
358	Refrigeration and service machinery
3581	Automatic merchandising machines
3582	Commercial laundry equipment
3585	Refrigeration and heating equipment
3586	Measuring and dispensing pumps
3589	Service industry machinery, nec
359	Misc. machinery, except electrical
3592	Carburetors, pistons, rings, valves
3599	Machinery, except electrical, nec
36	Electric and electronic equipment
361	Electric distributing equipment
3612	Transformers
3613	Switchgear and switchboard apparatus
362	Electrical industrial apparatus
3621	Motors and generators
3622	Industrial controls
3623	Welding apparatus, electric
3624	Carbon and graphite products
3629	Electrical industrial apparatus, nec
363	Household appliances
3631	Household cooking equipment
3632	Household refrigerators and freezers
3633	Household laundry equipment
3634	Electric housewares and fans
3635	Household vacuum cleaners
3636	Sewing machines
3639	Household appliances, nec
364	Electric lighting and wiring equipment
3641	Electric lamps
3643	Current-carrying wiring devices
3644	Noncurrent-carrying wiring devices
3645	Residential lighting fixtures

3646	Commercial lighting fixtures
3647	Vehicular lighting equipment
3648	Lighting equipment, nec
365	Radio and tv receiving equipment
3651	Radio and tv receiving sets
3652	Phonograph records
366	Communication equipment
3661	Telephone and telegraph apparatus
3662	Radio and tv communication equipment
367	Electronic components and accessories
3671	Electron tubes, receiving type
3672	Cathode ray television picture tubes
3673	Electron tubes, transmitting
3674	Semiconductors and related devices
3675	Electronic capacitors
3676	Electronic resistors
3677	Electronic coils and transformers
3678	Electronic connectors
3679	Electronic components, nec
369	Misc. electrical equipment & supplies
3691	Storage batteries
3692	Primary batteries, dry and wet
3693	X-ray apparatus and tubes
3694	Engine electrical equipment
3699	Electrical equipment & supplies, nec
37	Transportation equipment
371	Motor vehicles and equipment
3711	Motor vehicles and car bodies
3713	Truck and bus bodies
3714	Motor vehicle parts and accessories
3715	Truck trailers
3716	Motor Homes
372	Aircraft and parts
3721	Aircraft
3724	Aircraft engines and engine parts
3728	Aircraft equipment, nec
373	Ship and boat building and repairing
3731	Ship building and repairing
3732	Boat building and repairing
374	Railroad equipment
3743	Railroad equipment
375	Motorcycles, bicycles, and parts
3751	Motorcycles, bicycles, and parts
376	Guided missiles, space vehicles, parts
3761	Guided missiles and space vehicles
3764	Space propulsion units and parts
3769	Space vehicle equipment, nec
379	Miscellaneous transportation equipment
3792	Travel trailers and campers
3795	Tanks and tank components
3799	Transportation equipment, nec
38	Instruments and related products
381	Engineering & scientific instruments
3811	Engineering & scientific instruments
382	Measuring and controlling devices
3822	Environmental controls
3823	Process control instruments
3824	Fluid meters and counting devices
3825	Instruments to measure electricity
3829	Measuring & controlling devices, nec
383	Optical instruments and lenses
3832	Optical instruments and lenses
384	Medical instruments and supplies
3841	Surgical and medical instruments
3842	Surgical appliances and supplies
3843	Dental equipment and supplies
385	Ophthalmic goods
3851	Ophthalmic goods
386	Photographic equipment and supplies
3861	Photographic equipment and supplies
387	Watches, clocks, and watchcases
3873	Watches, clocks, and watchcases
39	Miscellaneous manufacturing industries
391	Jewelry, silverware, and plated ware
3911	Jewelry, precious metal
3914	Silverware and plated ware
3915	Jewelers' materials & lapidary work
393	Musical instruments
3931	Musical instruments
394	Toys and sporting goods
3942	Dolls
3944	Games, toys, and children's vehicles
3949	Sporting and athletic goods, nec
395	Pens, pencils, office and art supplies
3951	Pens and mechanical pencils
3952	Lead pencils and art goods
3953	Marking devices
3955	Carbon paper and inked ribbons
396	Costume jewelry and notions
3961	Costume jewelry
3962	Artificial flowers
3963	Buttons
3964	Needles, pins, and fasteners
399	Miscellaneous manufactures
3991	Brooms and brushes
3993	Signs and advertising displays
3995	Burial caskets
3996	Hard surface floor coverings
3999	Manufacturing industries, nec
E	Transportation and public utilities
40	Railroad transportation
401	Railroads
4011	Railroads, line-haul operating
4013	Switching and terminal services
41	Local and interurban passenger transit
411	Local and suburban transportation
4111	Local and suburban transit
4119	Local passenger transportation, nec
412	Taxicabs
4121	Taxicabs
413	Intercity highway transportation
4131	Intercity highway transportation
414	Transportation charter service
4141	Local passenger charter service
4142	Charter service, except local
415	School buses
4151	School buses
417	Bus terminal and service facilities
4171	Bus terminal facilities
4172	Bus service facilities

42	Trucking and warehousing
421	Trucking, local and long distance
4212	Local trucking, without storage
4213	Trucking, except local
4214	Local trucking and storage
422	Public warehousing
4221	Farm product warehousing and storage
4222	Refrigerated warehousing
4224	Household goods warehousing
4225	General warehousing and storage
4226	Special warehousing and storage, nec
423	Trucking terminal facilities
4231	Trucking terminal facilities
43	U.s. postal service
431	U.s. postal service
4311	U.s. postal service
44	Water transportation
441	Deep sea foreign transportation
4411	Deep sea foreign transportation
442	Deep sea domestic transportation
4421	Noncontiguous area transportation
4422	Coastwise transportation
4423	Intercoastal transportation
443	Great lakes transportation
4431	Great lakes transportation
444	Transportation on rivers and canals
4441	Transportation on rivers and canals
443	Local water transportation
4452	Ferries
4453	Lighterage
4454	Towing and tugboat service
4459	Local water transportation, nec
446	Water transportation services
4463	Marine cargo handling
4464	Canal operation
4469	Water transportation services, nec
45	Transportation by air
451	Certificated air transportation
4511	Certificated air transportation
452	Noncertificated air transportation
4521	Noncertificated air transportation
458	Air transportation services
4582	Airports and flying fields
4583	Airport terminal services
46	Pipe lines, except natural gas
461	Pipe lines, except natural gas
4612	Crude petroleum pipe lines
4613	Refined petroleum pipe lines
4619	Pipe lines, nec
47	Transportation services
471	Freight forwarding
4712	Freight forwarding
472	Arrangement of transportation
4722	Passenger transportation arrangement
4723	Freight transportation arrangement
474	Rental of railroad cars
4742	Railroad car rental with service
4743	Railroad car rental without service
478	Miscellaneous transportation services
4782	Inspection and weighing services
4783	Packing and crating
4784	Fixed facilities for vehicles, nec
4789	Transportation services, nec
48	Communication
481	Telephone communication
4811	Telephone communication
482	Telegraph communication
4821	Telegraph communication
483	Radio and television broadcasting
4832	Radio broadcasting
4833	Television broadcasting
489	Communication services, nec
4899	Communication services, nec
49	Electric, gas, and sanitary services
491	Electric services
4911	Electric services
492	Gas production and distribution
4922	Natural gas transmission
4923	Gas transmission and distribution
4924	Natural gas distribution
4925	Gas production and/or distribution
493	Combination utility services
4931	Electric and other services combined
4932	Gas and other services combined
4939	Combination utility services, nec
494	Water supply
4941	Water supply
495	Sanitary services
4952	Sewerage systems
4953	Refuse systems
4959	Sanitary services, nec
496	Steam supply
4961	Steam supply
497	Irrigation systems
4971	Irrigation systems
F	Wholesale trade
50	Wholesale trade-durable goods
501	Motor vehicles & automotive equipment
5012	Automobiles and other motor vehicles
5013	Automotive parts and supplies
5014	Tires and tubes
502	Furniture and home furnishings
5021	Furniture
5023	Home furnishings
503	Lumber and construction materials
5031	Lumber, plywood and millwork
5039	Construction materials, nec
504	Sporting goods, toys and hobby goods
5041	Sporting and recreational goods
5042	Toys and hobby goods and supplies
5043	Photographic equipment and supplies
505	Metals and minerals, except petroleum
5051	Metals service centers and offices
5052	Coal and other minerals and ores
506	Electrical goods
5063	Electrical apparatus and equipment
5064	Electrical appliances, tv and radios
5065	Electronic parts and equipment
507	Hardware, plumbing & heating equipment
5072	Hardware

5074	Plumbing & hydronic heating supplies
5075	Warm air heating & air conditioning
5078	Refrigeration equipment and supplies
508	Machinery, equipment, and supplies
5081	Commercial machines and equipment
5082	Construction and mining machinery
5083	Farm machinery and equipment
5084	Industrial machinery and equipment
5085	Industrial supplies
5086	Professional equipment and supplies
5087	Service establishment equipment
5088	Transportation equipment & supplies
509	Miscellaneous durable goods
5093	Scrap and waste materials
5094	Jewelry, watches, & precious stones
5099	Durable goods, nec
51	Wholesale trade-nondurable goods
511	Paper and paper products
5111	Printing and writing paper
5112	Stationery supplies
5113	Industrial & personal service paper
512	Drugs, proprietaries, and sundries
5122	Drugs, proprietaries, and sundries
513	Apparel, piece goods and notions
5133	Piece goods
5134	Notions and other dry goods
5136	Men's clothing and furnishings
5137	Women's and children's clothing
5139	Footwear
514	Groceries and related products
5141	Groceries, general line
5142	Frozen foods
5143	Dairy products
5144	Poultry and poultry products
5145	Confectionery
5146	Fish and seafoods
5147	Meats and meat products
5148	Fresh fruits and vegetables
5149	Groceries and related products, nec
515	Farm-product raw materials
5152	Cotton
5153	Grain
5154	Livestock
5159	Farm-product raw materials, nec
516	Chemicals and allied products
5161	Chemicals and allied products
517	Petroleum and petroleum products
5171	Petroleum bulk stations & terminals
5172	Petroleum products, nec
518	Beer, wine, and distilled beverages
5181	Beer and ale
5182	Wines and distilled beverages
519	Misc. nondurable goods
5191	Farm supplies
5194	Tobacco and tobacco products
5198	Paints, varnishes, and supplies
5199	Nondurable goods, nec
G	Retail trade
52	Building materials & garden supplies
521	Lumber and other building materials
5211	Lumber and other building materials
523	Paint, glass, and wallpaper stores
5231	Paint, glass, and wallpaper stores
525	Hardware stores
5251	Hardware stores
526	Retail nurseries and garden stores
5261	Retail nurseries and garden stores
527	Mobile home dealers
5271	Mobile home dealers
53	General merchandise stores
531	Department stores
5311	Department stores
533	Variety stores
5331	Variety stores
539	Misc. general merchandise stores
5399	Misc. general merchandise stores
54	Food stores
541	Grocery stores
5411	Grocery stores
542	Meat markets & freezer provisioners
5422	Freezer and locker meat provisioners
5423	Meat and fish (seafood) markets
543	Fruit stores and vegetable markets
5431	Fruit stores and vegetable markets
544	Candy, nut, and confectionery stores
5441	Candy, nut, and confectionery stores
545	Dairy products stores
5451	Dairy products stores
546	Retail bakeries
5462	Retail bakeries-baking and selling
5463	Retail bakeries-selling only
549	Miscellaneous food stores
5499	Miscellaneous food stores
55	Automotive dealers & service stations
551	New and used car dealers
5511	New and used car dealers
552	Used car dealers
5521	Used car dealers
553	Auto and home supply stores
5531	Auto and home supply stores
554	Gasoline service stations
5541	Gasoline service stations
555	Boat dealers
5551	Boat dealers
556	Recreation & utility trailer dealers
5561	Recreation & utility trailer dealers
557	Motorcycle dealers
5571	Motorcycle dealers
559	Automotive dealers, nec
5599	Automotive dealers, nec
56	Apparel and accessory stores
561	Men's & boys' clothing & furnishings
5611	Men's & boys' clothing & furnishings
562	Women's ready-to-wear stores
5621	Women's ready-to-wear stores
563	Women's accessory & specialty stores
5631	Women's accessory & specialty stores
564	Children's and infants' wear stores
5641	Children's and infants' wear stores
565	Family clothing stores

5651	Family clothing stores
566	Shoe stores
5661	Shoe stores
568	Furriers and fur shops
5681	Furriers and fur shops
569	Miscellaneous apparel & accessories
5699	Miscellaneous apparel & accessories
57	Furniture and home furnishings stores
571	Furniture and home furnishings stores
5712	Furniture stores
5713	Floor covering stores
5714	Drapery and upholstery stores
5719	Misc. home furnishings stores
572	Household appliance stores
5722	Household appliance stores
573	Radio, television, and music stores
5732	Radio and television stores
5733	Music stores
58	Eating and drinking places
581	Eating and drinking places
5812	Eating places
5813	Drinking places
59	Miscellaneous retail
591	Drug stores and proprietary stores
5912	Drug stores and proprietary stores
592	Liquor stores
5921	Liquor stores
593	Used merchandise stores
5931	Used merchandise stores
594	Miscellaneous shopping goods stores
5941	Sporting goods and bicycle shops
5942	Book stores
5943	Stationery stores
5944	Jewelry stores
5945	Hobby, toy, and game shops
5946	Camera & photographic supply stores
5947	Gift, novelty, and souvenir shops
5948	Luggage and leather goods stores
5949	Sewing, needlework, and piece goods
596	Nonstore retailers
5961	Mail order houses
5962	Merchandising machine operators
5963	Direct selling organizations
598	Fuel and ice dealers
5982	Fuel and ice dealers, nec
5983	Fuel oil dealers
5984	Liquified petroleum gas dealers
599	Retail stores, nec
5992	Florists
5993	Cigar stores and stands
5994	News dealers and newsstands
5999	Miscellaneous retail stores, nec
H	Finance, insurance, and real estate
60	Banking
601	Federal reserve banks
6011	Federal reserve banks
602	Commercial and stock savings banks
6022	State banks, federal reserve
6023	State banks, not fed. reserve, fdic
6024	State banks, not fed. res., not fdic
6025	National banks, federal reserve
6026	National banks, not fed. res., fdic
6027	National banks, not fdic
6028	Private banks, not incorp., not fdic
603	Mutual savings banks
6032	Mutual savings banks, fed. reserve
6033	Mutual savings banks, nec
6034	Mutual savings banks, not fdic
604	Trust companies, nondeposit
6042	Nondeposit trusts, federal reserve
6044	Nondeposit trusts, not fdic
605	Functions closely related to banking
6052	Foreign exchange establishments
6054	Safe deposit companies
6055	Clearinghouse associations
6056	Corporations for banking abroad
6059	Functions related to banking, nec
61	Credit agencies other than banks
611	Rediscount and financing institutions
6112	Rediscounting, not for agricultural
6113	Rediscounting, for agricultural
612	Savings and loan associations
6122	Federal savings & loan associations
6123	State associations, insured
6124	State associations, noninsured, fhlb
6125	State associations, noninsured, nec
613	Agricultural credit institutions
6131	Agricultural credit institutions
614	Personal credit institutions
6142	Federal credit unions
6143	State credit unions
6144	Nondeposit industrial loan companies
6145	Licensed small loan lenders
6146	Installment sales finance companies
6149	Misc. personal credit institutions
615	Business credit institutions
6153	Short-term business credit
6159	Misc. business credit institutions
616	Mortgage bankers and brokers
6162	Mortgage bankers and correspondents
6163	Loan brokers
62	Security, commodity brokers & services
621	Security brokers and dealers
6211	Security brokers and dealers
622	Commodity contracts brokers, dealers
6221	Commodity contracts brokers, dealers
623	Security and commodity exchanges
6231	Security and commodity exchanges
628	Security and commodity services
6281	Security and commodity services
63	Insurance carriers
631	Life insurance
6311	Life insurance
632	Medical service and health insurance
6321	Accident and health insurance
6324	Hospital and medical service plans
633	Fire, marine, and casualty insurance
6331	Fire, marine, and casualty insurance
635	Surety insurance
6351	Surety insurance

636	Title insurance
6361	Title insurance
637	Pension, health, and welfare funds
6371	Pension, health, and welfare funds
639	Insurance carriers, nec
6399	Insurance carriers, nec
64	Insurance agents, brokers, & service
641	Insurance agents, brokers, & service
6411	Insurance agents, brokers, & service
65	Real estate
651	Real estate operators and lessors
6512	Nonresidential building operators
6513	Apartment building operators
6514	Dwelling operators, exc. apartments
6515	Mobile home site operators
6517	Railroad property lessors
6519	Real property lessors, nec
653	Real estate agents and managers
6531	Real estate agents and managers
654	Title abstract offices
6541	Title abstract offices
655	Subdividers and developers
6552	Subdividers and developers, nec
6553	Cemetery subdividers and developers
66	Combined real estate, insurance, etc
661	Combined real estate, insurance, etc
6611	Combined real estate, insurance, etc
67	Holding and other investment offices
671	Holding offices
6711	Holding offices
672	Investment offices
6722	Management investment, open-end
6723	Management investment, closed-end
6724	Unit investment trusts
6725	Face-amount certificate offices
673	Trusts
6732	Educational, religious, etc. trusts
6733	Trusts, nec
679	Miscellaneous investing
6792	Oil royalty traders
6793	Commodity traders
6794	Patent owners and lessors
6798	Real Estate Investment Trusts
6799	Investors, nec
I	**Services**
70	Hotels and other lodging places
701	Hotels, motels, and tourist courts
7011	Hotels, motels, and tourist courts
702	Rooming and boarding houses
7021	Rooming and boarding houses
703	Camps and trailering parks
7032	Sporting and recreational camps
7033	Trailering parks for transients
704	Membership-basis organization hotels
7041	Membership-basis organization hotels
72	Personal services
721	Laundry, cleaning, & garment services
7211	Power laundries, family & commercial
7212	Garment pressing & cleaners' agents
7213	Linen supply
7214	Diaper service
7215	Coin-operated laundries and cleaning
7216	Dry cleaning plants, except rug
7217	Carpet and upholstery cleaning
7218	Industrial launderers
7219	Laundry and garment services, nec
722	Photographic studios, portrait
7221	Photographic studios, portrait
723	Beauty shops
7231	Beauty shops
724	Barber shops
7241	Barber shops
725	Shoe repair and hat cleaning shops
7251	Shoe repair and hat cleaning shops
726	Funeral service and crematories
7261	Funeral service and crematories
729	Miscellaneous personal services
7299	Miscellaneous personal services
73	Business services
731	Advertising
7311	Advertising agencies
7312	Outdoor advertising services
7313	Radio, tv, publisher representatives
7319	Advertising, nec
732	Credit reporting and collection
7321	Credit reporting and collection
733	Mailing, reproduction, stenographic
7331	Direct mail advertising services
7332	Blueprinting and photocopying
7333	Commercial photography and art
7339	Stenographic and reproduction, nec
734	Services to buildings
7341	Window cleaning
7342	Disinfecting and exterminating
7349	Building maintenance services, nec
735	News syndicates
7351	News syndicates
736	Personnel supply services
7361	Employment agencies
7362	Temporary help supply services
7369	Personnel supply services, nec
737	Computer and data processing services
7372	Computer programming and software
7374	Data processing services
7379	Computer related services, nec
739	Miscellaneous business services
7391	Research & development laboratories
7392	Management and public relations
7393	Detective and protective services
7394	Equipment rental and leasing
7395	Photofinishing laboratories
7396	Trading stamp services
7397	Commercial testing laboratories
7399	Business services, nec
75	Auto repair, services, and garages
751	Automotive rentals, without drivers
7512	Passenger car rental and leasing
7513	Truck rental and leasing
7519	Utility trailer rental
752	Automobile parking

7523	Parking lots
7525	Parking structures
753	Automotive repair shops
7531	Top and body repair shops
7534	Tire retreading and repair shops
7535	Paint shops
7538	General automotive repair shops
7539	Automotive repair shops, nec
754	Automotive services, except repair
7542	Car washes
7549	Automotive services, nec
76	Miscellaneous repair services
762	Electrical repair shops
7622	Radio and television repair
7623	Refrigeration service and repair
7629	Electrical repair shops, nec
763	Watch, clock, and jewelry repair
7631	Watch, clock, and jewelry repair
764	Reupholstery and furniture repair
7641	Reupholstery and furniture repair
769	Miscellaneous repair shops
7692	Welding repair
7694	Armature rewinding shops
7699	Repair services, nec
78	Motion pictures
781	Motion picture production & services
7813	Motion picture production, except tv
7814	Motion picture production for tv
7819	Services allied to motion pictures
782	Motion picture distribution & services
7823	Motion picture film exchanges
7824	Film or tape distribution for tv
7829	Motion picture distribution services
783	Motion picture theaters
7832	Motion picture theaters, ex drive-in
7833	Drive-in motion picture theaters
79	Amusement & recreation services, nec
791	Dance halls, studios, and schools
7911	Dance halls, studios, and schools
792	Producers, orchestras, entertainers
7922	Theatrical producers and services
7929	Entertainers & entertainment groups
793	Bowling and billiard establishments
7932	Billiard and pool establishments
7933	Bowling alleys
794	Commercial sports
7941	Sports clubs, managers, & promoters
7948	Racing, including track operation
799	Misc. amusement, recreational services
7992	Public golf courses
7993	Coin-operated amusement devices
7996	Amusement parks
7997	Membership sports & recreation clubs
7999	Amusement and recreation, nec
80	Health services
801	Offices of physicians
8011	Offices of physicians
802	Offices of dentists
8021	Offices of dentists
803	Offices of osteopathic physicians
8031	Offices of osteopathic physicians
804	Offices of other health practitioners
8041	Offices of chiropractors
8042	Offices of optometrists
8049	Offices of health practitioners, nec
805	Nursing and personal care facilities
8051	Skilled nursing care facilities
8059	Nursing and personal care, nec
806	Hospitals
8062	General medical & surgical hospitals
8063	Psychiatric hospitals
8069	Specialty hospitals, exc psychiatric
807	Medical and dental laboratories
8071	Medical laboratories
8072	Dental laboratories
808	Outpatient care facilities
8081	Outpatient care facilities
809	Health and allied services, nec
8091	Health and allied services, nec
81	Legal services
811	Legal services
8111	Legal services
82	Educational services
821	Elementary and secondary schools
8211	Elementary and secondary schools
822	Colleges and universities
8221	Colleges and universities, nec
8222	Junior colleges
823	Libraries and information centers
8231	Libraries and information centers
824	Correspondence and vocational schools
8241	Correspondence schools
8243	Data processing schools
8244	Business and secretarial schools
8249	Vocational schools, nec
829	Schools & educational services, nec
8299	Schools & educational services, nec
83	Social services
832	Individual and family services
8321	Individual and family services
833	Job training and related services
8331	Job training and related services
835	Child day care services
8351	Child day care services
836	Residential care
8361	Residential care
839	Social services, nec
8399	Social services, nec
84	Museums, botanical, zoological gardens
841	Museums and art galleries
8411	Museums and art galleries
842	Botanical and zoological gardens
8421	Botanical and zoological gardens
86	Membership organizations
861	Business associations
8611	Business associations
862	Professional organizations
8621	Professional organizations
863	Labor organizations
8631	Labor organizations

864	Civic and social associations
8641	Civic and social associations
865	Political organizations
8651	Political organizations
866	Religious organizations
8661	Religious organizations
869	Membership organizations, nec
8699	Membership organizations, nec
88	Private households
881	Private households
8811	Private households
89	Miscellaneous services
891	Engineering & architectural services
8911	Engineering & architectural services
892	Noncommercial research organizations
8922	Noncommercial research organizations
893	Accounting, auditing, & bookkeeping
8931	Accounting, auditing, & bookkeeping
899	Services, nec
8999	Services, nec
J	Public administration
91	Executive, legislative, and general
911	Executive offices
9111	Executive offices
912	Legislative bodies
9121	Legislative bodies
913	Executive and legislative combined
9131	Executive and legislative combined
919	General government, nec
9199	General government, nec
92	Justice, public order, and safety
921	Courts
9211	Courts
922	Public order and safety
9221	Police protection
9222	Legal counsel and prosecution
9223	Correctional institutions
9224	Fire protection
9229	Public order and safety, nec
93	Finance, taxation, & monetary policy
931	Finance, taxation, & monetary policy
9311	Finance, taxation, & monetary policy
94	Admininistration of human resources
941	Admin. of educational programs
9411	Admin. of educational programs
943	Admin. of public health programs
9431	Admin. of public health programs
944	Admin. of social & manpower programs
9441	Admin. of social & manpower programs
945	Administration of veterans' affairs
9451	Administration of veterans' affairs
95	Environmental quality and housing
951	Environmental quality
9511	Air, water & solid waste management
9512	Land, mineral, wildlife conservation
953	Housing and urban development
9531	Housing programs
9532	Urban and community development
96	Administration of economic programs
961	Admin. of general economic programs
9611	Admin. of general economic programs
962	Regulation, admin. of transportation
9621	Regulation, admin. of transportation
963	Regulation, admin. of utilities
9631	Regulation, admin. of utilities
964	Regulation of agricultural marketing
9641	Regulation of agricultural marketing
965	Regulation misc. commercial sectors
9651	Regulation misc. commercial sectors
966	Space research and technology
9661	Space research and technology
97	National security and intl. affairs
971	National security
9711	National security
972	International affairs
9721	International affairs
K	Nonclassifiable establishments
99	Nonclassifiable establishments
999	Nonclassifiable establishments
9999	Nonclassifiable establishments

APPENDIX F

SOURCE CATEGORY/POLLUTANT INDEX

APPENDIX F
SOURCE CATEGORY/POLLUTANT INDEX

This appendix presents several tables that match source category and toxic air pollutant. The material is excerpted from an EPA document (EPA 625/6-86-011a) entitled "Evaluation of Control Technologies for Hazardous Air Pollutants, Volume 1, Technical Report."

The tables are presented by source category (solvent usage, metallurgical industry, etc.). In addition to listing toxic air pollutants, the tables also list some specific sources of the pollutants (dryers, reactors, furnaces, kettles, filters, etc.) within each source category.

This information is presented to assist agencies that do not choose to or are not able to use pollutant/SIC or SIC/pollutant indices. The data may also be useful in cases where SIC/pollutant indices are not specific enough or are too specific.

As is true of the other indices presented in these Appendices, these data do not define the quantity of pollutant emitted. Quantities emitted may range from trace amounts to tons per year.

TABLE F-1 POTENTIAL HAP'S FOR SOLVENT USAGE OPERATIONS

Source Category	Hazardous Air Pollutants				References pg. F-30
	Organic		Inorganic		
	Vapor	Particulate	Vapor	Particulate	
Solvent Degreasing	x				2,3,4,15
Dry Cleaning	x				3,5,9,15
Graphic Arts[a]	x				3,5,6,15
Waste Solvent Reclaiming	x				5
SC[b]-Flatwood Paneling[c]	x				1,5,6
SC-Machinery[d]	x			x	1,7
SC-Appliances[e]	x			x	1,5
SC-Metal Furniture	x			x	1,12
SC-Auto/Truck[f]	x			x	1,5,12
SC-Fabrics	x				5,15
SC-Cans[g]	x				1,5,6,8
SC-Paper, Tapes, Labels	x				1,5,13
Magnetic Tape Coating	x				10,11
SC-Electrical Insulation	x				1,15
SC-Marine Vessels[h]	x			x	1,3,20
Vinyl & Acrylic Coatings[i]	x				3,16
SC-Wood Furniture	x				1,17
SC-Trans. Vehicles[j]	x			x	1,20
Machine Lubricants	x				33
Rubber Tire Manufacturing	x				34

[a] Category includes flexography, lithography, offset printing, and textile printing.

[b] SC: surface coating.

[c] Category includes coating of other flat stock.

[d] Category includes coating of misc. metal parts, machinery, and equipment.

[e] Category includes all categories of appliances: large and small.

[f] Category includes coating of automobiles and light-duty trucks.

[g] Category includes surface coating of coils, cans, containers, and closures.

[h] Category includes coating and maintenance of marine vessels.

[i] Category includes vinyl, acrylic, and nitrocellulose coatings.

[j] Category includes coating of trucks, buses, railroad cars, airplanes, etc.

TABLE F-2 EMISSION SOURCES FOR SOLVENT USAGE OPERATIONS

	Potential HAP Emission Sources		
Source Category	Process Point	Process Fugitive	Area Fugitive
Solvent Degreasing	C	A,B,D	K
Dry Cleaning	F	E,G,H,I	J,K
Graphic Arts	F	L,M,N	
Waste Solvent Reclaiming	N	I	J,K
SC-Flatwood Paneling	0	L,P	
SC-Machinery	0	Q,R	
SC-Appliances	0	Q,R	
SC-Metal Furniture	0	Q,R	
SC-Auto/Truck	0	S,R	
SC-Fabrics	0	D,K,Q,R,T	
SC-Cans	0	Q,U	
SC-Paper, Tapes, Labels	0	B,I,Q,T	
Magnetic Tape Coating	F	I,Q,T	
SC-Electrical Insulation	0	Q	
SC-Marine Vessels			Q
Vinyl & Acrylic Coatings	0	L,P	
SC-Wood Furniture	0	S,R,T	
SC-Trans. Vehicles		S,R	
Machine Lubricants			Q
Rubber Tire Manufacturing	F	I,V,W	

Source Key

A - bath evaporation
B - solvent transfer
C - ventilation
D - waste solvent disposal
E - washer
F - drying
G - still, filtration
H - cooker
I - solvent storage
J - pipes, flanges, pumps
K - transfer areas
L - rollers
M - ink fountains
N - condenser
O - oven
P - coaters
Q - application area
R - flashoff area
S - spray booth
T - solvent/coating mixing
U - quench area
V - green tire spraying
W - sidewall/tread end/undertread cementing

TABLE F-2 EMISSION SOURCES FOR SOLVENT USAGE OPERATIONS

	Potential HAP Emission Sources		
Source Category	Process Point	Process Fugitive	Area Fugitive
Solvent Degreasing	C	A,B,D	K
Dry Cleaning	F	E,G,H,I	J,K
Graphic Arts	F	L,M,N	
Waste Solvent Reclaiming	N	I	J,K
SC-Flatwood Paneling	O	L,P	
SC-Machinery	O	Q,R	
SC-Appliances	O	Q,R	
SC-Metal Furniture	O	Q,R	
SC-Auto/Truck	O	S,R	
SC-Fabrics	O	D,K,Q,R,T	
SC-Cans	O	Q,U	
SC-Paper, Tapes, Labels	O	B,I,Q,T	
Magnetic Tape Coating	F	I,Q,T	
SC-Electrical Insulation	O	Q	
SC-Marine Vessels			Q
Vinyl & Acrylic Coatings	O	L,P	
SC-Wood Furniture	O	S,R,T	
SC-Trans. Vehicles		S,R	
Machine Lubricants			Q
Rubber Tire Manufacturing	F	I,V,W	

Source Key

A - bath evaporation
B - solvent transfer
C - ventilation
D - waste solvent disposal
E - washer
F - drying
G - still, filtration
H - cooker
I - solvent storage
J - pipes, flanges, pumps
K - transfer areas

L - rollers
M - ink fountains
N - condenser
O - oven
P - coaters
Q - application area
R - flashoff area
S - spray booth
T - solvent/coating mixing
U - quench area
V - green tire spraying
W - sidewall/tread end/undertread cementing

TABLE F-3 POTENTIAL HAP'S FOR METALLURGICAL INDUSTRIES

Source Category	Hazardous Air Pollutants Organic Vapor	 Particulate	 Inorganic Vapor	 Particulate	References pg. F-30
Primary Aluminum Production			l	l	5,23,25
Primary Cadmium Production				i	36
Metallurgical Coke	c,h,m,s,u, w,z,A,B,D	r	d,C	a,e,f,g,i,n, o,p,q,t,v	5,24,25,27, 28,31,35,36
Primary Copper Smelting		r	a,l	a,e,i,k, n,o,t,x	5,18,23,24,25 30,31,32,36
Ferroalloy Production		r		i,j,k,n,p, q,v,x	5,19,21,22, 24,25,27,30, 32,35
Iron and Steel Production		r	l	f,i,j,k,n, p,q,v,x	5,23,24,25, 26,30,32,35,36
Primary Lead Smelting		r	a,l	a,e,i,k, n,o,t	5,18,23,24, 25,30,32,36
Primary Zinc Smelting		r	a,l	a,i,k,n, o,t,x	5,18,23,24, 25,30,31,32,36
Manganese Production		r		p	23,24,26,35
Nickel Production		r	a,l	a,i,n,q,t,x	23,24,35
Secondary Aluminum Operations			l	l,q	5,27
Secondary Copper Operations (Brass and Bronze Production)		r	x	i,k,n, q,t,x	5,23,25,27, 30,32
Gray Iron Foundries	b,c,m, s,u,w	r		a,f,g,i,j, k,n,o,p,q, v,x,y	5,21,23,24 25,26,27,30, 32,35
Secondary Lead Smelting		r		a,n,p,t	5,21,23,24,25
Steel Foundries				a,j,g, p,q,y	5,24,25,26, 27,35
Secondary Zinc Processing			x	i,o,q,t,x	5,24,25,27,37

(Continued)

TABLE F-3 POTENTIAL HAP'S FOR METALLURGICAL INDUSTRIES
(concluded)

Source Category	Hazardous Air Pollutants Organic Vapor	 Organic Particulate	 Inorganic Vapor	 Inorganic Particulate	References pg. F-30
Lead Acid Battery Production			n	n	5,30
Cadmium-Nickel Battery Prod.				i,n	24,27,35
Dry Battery Production				p	24,26,35
Misc. Lead Products			n	e,n	5

Pollutant Key

a - arsenic
b - acrolein
c - acetaldehyde
d - ammonia
e - antimony
f - barium
g - beryllium
h - benzene
i - cadmium
j - chromium
k - copper
l - fluoride
m - formaldehyde
n - lead
o - mercury
p - manganese
q - nickel
r - polycyclic organic matter (POM)
s - phenol
t - selenium
u - toluene
v - vanadium
w - xylene
x - zinc
y - iron
z - cresols
A - cyanides
B - pyridine
C - hydrogen sulfide
D - methyl mercaptan

TABLE F-4 EMISSION SOURCES FOR METALLURGICAL INDUSTRIES

	Potential HAP Emission Sources		
Source Category	Process Point	Process Fugitive	Area Fugitive
Primary Aluminum Production	A, J,M,N,R	H,K,D	N,Q,U,Z
Primary Cadmium Production	J,E	O,P	N,Z
Metallurgical Coke	B	C,O,X	N,D,Q,U
Primary Copper Smelting	F,J,T	G,H,K,O,P,X	N,Q,U,W,Z
Ferroalloy Production	J	H,K,O,P	N,Q,W
Iron and Steel Production	B,J,V	C,H,K,O,X	D,N,Q,U,W,Z
Primary Lead Smelting	J,V	H,K,O,P	N,Q,U,W,Z
Primary Zinc Smelting	E,J,T,S	O	N,Q,U,W,Z
Manganese Production	J	H,K,M,P	N,Q,Z
Nickel Production	A, J,M,T	P	N,Q,Z
Secondary Aluminum Operations	J	H,K,P	U
Secondary Copper Operations	J	H,K,P	U
Gray Iron Foundries	J,Y	H,K,G,P	U
Secondary Lead Smelting	J	H,K,P	U,Q
Steel Foundries	J,Y	G,H,K,P	U
Secondary Zinc Processing	J,E,S	H,K,L,P	U
Lead Acid Battery Production		O,P	
Cadmium-Nickel Battery Prod.	V	N,O	
Dry Battery Production		M,N,O	
Misc. Lead Products		G,O,P	

Source Key

A - calciner
B - coke oven
C - coke oven charging/pushing
D - coke quenching
E - condenser
F - converter
G - converter charging/etc.
H - furnace tapping
J - furnace
K - furnace charging
L - galvanizing vessel
M - material crusher/mill

N - material storage and handling
O - material preparation
P - metal casting
Q - outdoor storage pile
R - reduction cell
S - retort
T - roaster
U - service road
V - sintering machine
W - slag dumping
X - vessel leakage
Y - foundry mold & core decomposition
Z - mining operations

TABLE F-5 EMISSION SOURCES FOR THE SOCMI[a]

Source Category (Generic Source)	Potential HAP Emission Sources (Specific)		
	Process Point	Process Fugitive	Area Fugitive[b]
Storage and Handling		A	B,C,D
Reactor Processes	E,F	G	C,D,H I,J,K
Separation Processes	F,L	G,M,N	K
Fugitives		G,M,N	B,C,D,H,I J,K,M,N,O

[a] Sources: References 14, 38, 39, 40, 41, 42, and 43.

[b] Groups of small point sources (e.g., valves, compressors, pumps, etc.) at a SOCMI plant are considered as area fugitive sources in this manual.

Source Key

A - storage, transfer, and handling
B - spills
C - valves
D - flanges
E - reactors
F - product recovery devices (absorber, adsorber, condenser)
G - process drains
H - pumps
I - compressors
J - sampling lines
K - pressure relief devices
L - separation devices (distillation column, absorber, crystalizer, dryer, etc.)
M - hotwell
N - accumulator
O - cooling tower

TABLE F-6 POTENTIAL HAP'S FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY

Source Category	Hazardous Air Pollutants Inorganic Vapor	 Particulate	References pg. F-30
Aluminum chloride	f,l		25
Aluminum fluoride	s		25
Ammonia	a		5,25,44
Ammonium acetate	a		25
Ammonium-nitrate, sulfate thiocyanate, formate, tartrate	a		25,45,46
Ammonium phosphate	a,s		25
Antimony oxide	g		25
Arsenic-disulfide, iodide pentafluoride, thioarsenate tribromide, trichloride, trifluoride, trioxide orthoarsenic acid	d	d	15,47
Barium-carbonate, chloride hydroxide, sulfate, sulfide		h	25,48
Beryllium-oxide, hydroxide		i	15,24,25
Boric acid and Borax		k	25
Bromine	j,l		25
Cadmium (pigment)-sulfide sulfoselenide, lithopone		q	15,25,49
Calcium-carbide, arsenate phosphate	e,s	d	15,24,25,47
Chlorine	l	B	5,25,29,49
Chlorosulfonic acid	u,K		25
Chromic acid	n	m,n	22,24,25

(continued)

TABLE F-6 POTENTIAL HAP'S FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY (continued)

Source Category	Hazardous Air Pollutants Inorganic Vapor	 Particulate	References pg. F-30
Chromium-acetate, borides halides etc.		m	15,22,24,25
Chromium (pigment)-oxide		m	15,22,24,25
Cobalt-acetate, carbonate halides, etc.		o	25
Copper sulfate	p		25,32
Fluorine	s		25
Hydrazine	a,P		25
Hydrochloric acid	u,v	v	5,25
Hydrofluoric acid	s		5,25
Iodine (crude)	l	O	25
Iron chloride	l,v	v	25
Iron (pigment)-oxide	Q		25
Lead-arsenate, halides hydroxides, dioxide, nitrate	e	d,x	15,24,25,30,47
Lead chromate	y		25
Lead (pigments)-oxide carbonate, sulfate		x	5,25,30
Manganese dioxide (Potassium permanganate)	A	z	15,24,25,26,35
Manganese sulfate		z	15,24,25,26,35
Mercury-halides, nitrates, oxides		B	15,24,25,29,31
Nickel-halides, nitrates, oxides		C	15,24,25,27

(continued)

TABLE F-6 POTENTIAL HAP'S FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY (continued)

Source Category	Hazardous Air Pollutants		References
	Inorganic		
	Vapor	Particulate	pg. F-30
Nickel sulfate	D	C	15,24,25,27
Nitric acid	E	E	5,25,50
Phosphoric acid			
Wet Process -	1,s		
Thermal Process -	d,G,t	G	5,15,23,25
Phosphorus	s		25
Phosphorus oxychloride	1		25
Phosphorus pentasulfide	H,F	F	25
Phosphorus trichloride	I,1,F	F	25
Potassium-bichromate, chromate	r	r	22,24,25
Potassium hydroxide	1	B	15,24,25
Sodium arsenate		d	15,25,47
Sodium carbonate	a		5,25,51
Sodium chlorate	1		25
Sodium chromate-dichromate	r	r	22,24,25
Sodium hydrosulfide	t		25
Sodium-silicofluoride, fluoride	s		25
Sulfuric acid	J,K	J	5,25,52,53
Sulfur monochloride-dichloride	1		25
Zinc chloride	M,x	x	25

(continued)

TABLE F-6 POTENTIAL HAP'S FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY (concluded)

Source Category	Hazardous Air Pollutants Inorganic Vapor	 Particulate	References pg F-30
Zinc chromate (pigment)	L		25
Zinc oxide (pigment)	N		25

Pollutant Key

a - ammonia
d - arsenic
e - arsenic trioxide
f - aluminum chloride
g - antimony trioxide
h - barium salts
i - beryllium
j - bromine
k - boron salts
l - chlorine
m - chromium salts
n - chromic acid mist
o - cobalt metal fumes
p - copper sulfate
q - cadmium salts
r - chromates (chromium)
s - fluorine
t - hydrogen sulfide
u - hydrogen chloride
v - hydrochloric acid
x - lead
y - lead chromate
z - manganese salts
A - manganese dioxide
B - mercury
C - nickel
D - nickel sulfate
E - nitric acid mist
F - phosphorus
G - phosphoric acid mist
H - phosphorus pentasulfide
I - phosphorus trichloride
J - sulfuric acid mist
K - sulfur trioxide
L - zinc chromate
M - zinc chloride fume
N - zinc oxide fume
O - iodine
P - hydrazine
Q - iron oxide

TABLE F-7 EMISSION SOURCES FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY

Source Category	Potential HAP Emission Sources		
	Process Point	Process Fugitive	Area Fugitive
Aluminum chloride	X	X	
Aluminum fluoride	X	X	
Ammonia	B,D,E	K	J,S
Ammonium acetate	X	X	
Ammonium-nitrate, sulfate thiocyanate, formate, tartrate	C,F,I,L	Q	
Ammonium phosphate	X	X	
Antimony oxide	X	X	
Arsenic-disulfide, iodide pentafluoride, thioarsenate tribromide, trichloride, trifluoride, trioxide, orthoarsenic acid	H,U	K,Q,T	J,S
Barium-carbonate, chloride hydroxide, sulfate, sulfide	C,E,G,I,L,U	N,P,Q,T	
Beryllium-oxide, hydroxide	X	X	
Boric acid and Borax	X	X	
Bromine	X	X	
Cadmium (pigment)-sulfide sulfoselenide, lithopone	X	X	
Calcium-carbide, arsenate phosphate	H	K,P	
Chlorine	H,C	K,R	J
Chlorosulfonic acid	X	X	
Chromic acid	H	K,N,O,Q	J,S

(continued)

TABLE F-7 EMISSION SOURCES FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY (continued)

Source Category	Potential HAP Emission Sources Process Point	Process Fugitive	Area Fugitive
Chromium-acetate, borides halides, etc.	X	X	
Chromium (pigment)-oxide	X	X	
Cobalt-acetate, carbonate halides, etc.	X	X	
Copper sulfate	X	X	
Fluorine	X	X	
Hydrazine	X	X	
Hydrochloric acid	B		
Hydrofluoric acid	B,G	K,R	
Iodine (crude)	X	X	
Iron chloride	X	X	
Iron (pigment) - oxide	X	X	
Lead-arsenate, halides hydroxides, dioxide, nitrate	G,L	P,Q	
Lead chromate	G,R	P,Q	
Lead (pigments)-oxide carbonate, sulfate	G,R	P,Q	
Manganese dioxide (Potassium permanganate)	G,L	Q,P,T	
Manganese sulfate	G,L	Q,P,T	
Mercury-halides, nitrates, oxides	X	X	
Nickel-halides, nitrates, oxides		P,Q	

(continued)

TABLE F-7 EMISSION SOURCES FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY (continued)

Source Category	Potential HAP Emission Sources Process Point	 Process Fugitive	 Area Fugitive
Nickel sulfate	L	Q,T	
Nitric acid	B,H	K,N,R	J,S
Phosphoric acid			
Wet Process -	H,C,W	K,N,P,T	J,S
Thermal Process -	B,G	K,N,R,T	J,S
Phosphorus	X	X	
Phosphorus oxychloride	X	X	
Phosphorus pentasulfide	X	X	
Phosphorus trichloride	X	X	
Potassium-bichromate, chromate	I		
Potassium hydroxide	X	X	
Sodium arsenate	H	K,P	
Sodium carbonate	I,L,V	P	
Sodium chlorate	X	X	
Sodium chromate-dichromate	G,I,L,M	P,Q	
Sodium hydrosulfide	X	X	
Sodlim-silicofluoride, fluoride	X	X	
Sulfuric acid	A,B,C,H	K,R	J,S
Sulfur monochloride-dichloride	X	X	
Zinc chloride	X	X	

(continued)

TABLE F-7 EMISSION SOURCES FOR INORGANIC CHEMICAL MANUFACTURING INDUSTRY
(concluded)

	Potential HAP Emission Sources		
Source Category	Process Point	Process Fugitive	Area Fugitive
Zinc chromate (pigment)	X	X	
Zinc oxide (pigment)	X	X	

Source Key

A - converter
B - absorption tower
C - concentrator
D - desulfurizer
E - reformer
F - neutralizer
G - kiln
H - reactor
I - crystallizer
J - compressor and pump seals
K - storage tank vents
L - dryer
M - leaching tanks
N - filter
O - flakers
P - milling/grinding/crushing
Q - product handling and packaging
R - cooler (cooling tower, condenser)
S - pressure relief valves
T - raw material unloading
U - purification
V - calciner
W - hot well
X - no information

TABLE F-8 POTENTIAL HAP'S FOR THE CHEMICAL PRODUCTS INDUSTRY

	Hazardous Air Pollutants				
Source Category	Organic		Inorganic		References pg F-30
	Vapor	Particulate	Vapor	Particulate	
Carbon Black	n,o,u,P,x	O	a	a,g,j,k,B,C,K	15,24,25
Charcoal	d,w,D	O			15,24,25,54
Explosives	w				24,35
Fertilizers	w,z,R		W		5,15,24, 35,55
Paint & Varnish	p,v,E,T			f,B,Q,V	15,23,24,35
Pharmaceutical	q,r,E,H,T			B	15,24,35, 56,57,58
Plastics	w,G,I,M,P,X,Y,Z				15,24,25,35,59
Printing Ink	b,p,A,P,T,S				5,15,24,35
Pesticides	i,p,q,r,t,y, F,J,M,U,			B	15,24,35, 57,58,60
Soap and Detergents	h,H	O	a	a,e	23,24,35
Synthetic Fibers	c,h,m,n,s, w,F,L,N,P, T,x				15,24,25, 35,61
Synthetic Rubber	c,l,r,t,v, G,H,I,J,T,W	O			15,24,25, 35,61,62

(continued)

Pollutant Key (see next page).

TABLE F-8 POTENTIAL HAP'S FOR THE CHEMICAL PRODUCTS INDUSTRY (concluded)

Pollutant Key

a - arsenic
b - acrolein
c - acrylonitrile
d - acetic acid
e - boron
f - barium
g - beryllium
h - benzene
i - cresols
j - cadmium
k - chromium
l - chloroprene
m - caprolactum
n - carbon disulfide
o - carbonyl sulfide
p - carbon tetrachloride
q - chloroform
r - dichlorobenzene
s - dimethylformamide
t - dimethylamine
u - ethylene
v - ethylene dichloride
w - formaldehyde
x - hydrogen sulfide
y - hexachlorocyclopentadiene
z - hydrogen fluoride

A - ketones
B - mercury
C - manganese
D - methanol
E - methyl chloroform (1,1,1-trichloroethane)
F - maleic anhydride
G - butadiene, 1,3-
H - morpholine
I - methylene chloride
J - nitrosomines
K - nickel
L - perchloroethylene
M - phosgene
N - phthalic anhydride
O - polycyclic organic matter
P - phenol
Q - selenium
R - silicontetrafluoride
S - terpenes
T - toluene
U - xylene
V - zinc
W - ammonia
X - vinyl chloride
Y - toluene diisocyanate
Z - pyridine

TABLE F-9 EMISSION SOURCES FOR THE CHEMICAL PRODUCTS INDUSTRY

Source Category	Potential HAP Emission Sources Process Point	 Process Fugitive	 Area Fugitive
Carbon Black	B,H	G,K,L	I
Charcoal	E		
Explosives	A,C,H	K	
Fertilizers	D,H,R,S,V	K,T	
Paint and Varnish	N,O	L	
Pharmaceutical	A,H,U,W	G,L	F
Plastics	A,P,V	K,L	F,I
Printing Ink	Q		
Pesticides	A,H,O,X	G	F,I
Soap and Detergents	M,N,O	K,L	
Synthetic Fibers	A,H,J,O,U, V,X,Z	G,K	I
Synthetic Rubber	A,H,O,P,X,Z	Y	F

Source Key

A - reactor
B - furnace
C - concentrator
D - neutralizer
E - kiln
F - compressor and pump seals; valves, flanges, open ended lines, sampling lines
G - storage tank vents
H - dryer
I - spills
J - spin cell or bath
K - product handling, finishing, and packaging
L - raw material transport and unloading
M - spray dryer
N - kettle
O - mixing tank (blend tank)
P - polymerization vessel
Q - cooking vessel
R - prill tower
S - granulator
T - screen
U - distillation
V - cooler (condenser)
W - crystallizer
X - filter
Y - milling/blending/compounding
Z - flash tank

TABLE F-10 POTENTIAL HAP'S FOR THE MINERAL PRODUCTS INDUSTRY

	Hazardous Air Pollutants				
Source Category	Organic		Inorganic		References
	Vapor	Particulate	Vapor	Particulate	pg. F-30
Asbestos Products				c,j,q	23,24,27
Asphalt Batching Plants	b,h,m	r			5,15,23, 24,25,63
Brick, Ceramic, and Related Clay Prod.			j,l u,z	g,j,l	5,15,22,23, 24,25,64
Refractories			j,l	j,l	5,15,22, 24,65
Cement Manufacture		r	j,l, q,w	g,i,j,n, o,q,x,y	5,15,22,24, 25,26,27,30, 31,49,64,66
Coal Cleaning (Dry)				v	25,28
Coal Cleaning (Wet)				a,e,f,g,i,j,k, n,p,q,t,u,x	28,67
Coal Conversion	h,s, A,B	r	d,w	a,e,g,i,n, o,p,q,t,C	5,27,28,67
Glass Fiber Manuf.	m,s	s	f,t,u		5,23,68,69
Frit Manufacturing			l	l	5,23
Glass Manufacturing			a,d,l,n,z	a,e,f,l, n,t,u	5,15,23,24, 25,47,68
Lime Manufacturing			o	o	15,24,31,70 71
Mercury Ore Processing			o	o	29,31
Mineral Wool Manuf.	m,s		l,w		5,25,69,72
Perlite Manufacturing			l	l	5,15,73
Phosphate Rock Processing			f,t,u	f,t,u	15,24,25,74
Taconite Ore Processing				c	75

(continued)

Pollutant Key (see next page).

TABLE F-10 POTENTIAL HAP'S FOR THE MINERAL PRODUCTS INDUSTRY (concluded)

Pollutant Key

a - arsenic
b - aldehydes
c - asbestos
d - ammonia
e - antimony
f - barium
g - beryllium
h - benzene
i - cadmium
j - chromium
k - copper
l - fluoride
m - formaldehyde
n - lead
o - mercury
p - manganese
q - nickel
r - polycyclic organic matter (POM)
s - phenol
t - selenium
u - boron
v - coal dust
w - hydrogen sulfide
x - zinc
y - iron
z - chlorine
A - cresols
B - toluene
C - phosphorus

TABLE F-11 EMISSION SOURCES FOR THE MINERAL PRODUCTS INDUSTRY

Source Category	Potential HAP Emission Sources Process Point	Process Fugitive	Area Fugitive
Asbestos Products		D,N	I,L
Asphalt Batching Plants	B	F,J,M	I
Brick, Ceramic, and Related Clay Products	B,E,C	D,F,N	I,L
Refractories	B,E	D,F,N	I
Cement Manufacture	E	F,G,N,S	I,L
Coal Cleaning (Dry Process)		M,N,R	I,L
Coal Cleaning (Wet Process)	B,C	M,N	I,L
Coal Conversion	B,H	F,G,M,N	I,L
Glass Fiber Manufacturing	C,O	D,F,G,N,P	I
Frit Manufacturing	B,C	S	I,L
Glass Manufacturing	C	D,F,M,N	I
Lime Manufacturing	E,T	G,R,S	I,L
Mercury Ore Processing	C	G,N	I,L
Mineral Wool Manufacturing	C,O	D,G,P	I,L
Perlite Manufacturing	B,C	G,M,N,S	I,L
Phosphate Rock Processing	A,B,Q	F,M,N,R	I,L
Taconite Ore Processing	C,Q	F,M,N,R	I,L

Source Key

A - calciner
B - dryer
C - furnace
D - end-product forming and finishing
E - kiln
F - raw material preparation/mixing
G - cooling
H - reactor
I - storage pile
J - saturator
L - mining operations
M - raw material handling/transport
N - raw material crusher/mill
O - oven
P - resin application
Q - washers
R - screening
S - end-product handling/grinding/bagging
T - hydrator

TABLE F-12 POTENTIAL HAP'S FOR THE WOOD PRODUCTS INDUSTRY

Source Category	Hazardous Air Pollutants				References
	Organic		Inorganic		
	Vapor	Particulate	Vapor	Particulate	pg. F-30
Chemical Wood Pulping					
Kraft Pulp Mill	i	e	k	a,b,c,d	5,15,23, 24,25,76
Sulfite Pulp Mill	h	e	f,k	a,b,c,d	5,15,23, 24,25
Neutral Sulfite Pulp Mill		e	k	a,c,d	5,23,25
Plywood, Particleboard, Hardboard	h,l, o,p				5,24,35 75
Wood Preservative	g,m,n				24,35,58

Pollutant Key

a - arsenic
b - asbestos
c - chromium
d - mercury
e - polycyclic organic matter (POM)
f - chlorine
g - chlorobenzene
h - formaldehyde
i - methyl mercaptan

k - hydrogen sulfide
l - phenol
m - pentachlorophenol
n - cresols
o - abietic acid
p - pinene

TABLE F-13 EMISSION SOURCES FOR THE WOOD PRODUCTS INDUSTRY

Source Category	Potential HAP Emission Sources Process Point	Process Fugitive	Area Fugitive
Chemical Wood Pulping			
Kraft Pulp Mill	A,B,C,D		
Sulfite Pulp Mill	A,B,C		
Neutral Sulfite Pulp Mill	A,C,E		
Plywood, Particleboard, Hardboard	G	F	
Wood Preservative		F	

Source Key

A - recovery furnace
B - digester
C - blow tank
D - lime kiln
E - fluidized bed reactor
F - resin and/or adhesive application
G - dryer

TABLE F-14 POTENTIAL HAP'S FOR PETROLEUM RELATED INDUSTRIES[a]
(General Listing for Entire Source Category)

Hazardous Air Pollutants			
Organic		Inorganic	
Vapor	Particulate	Vapor	Particulate
Parafins (C_1-C_{10})	Coke fines	Sulfides (e.g., hydrogen sulfide, carbon disulfide, carbonyl sulfide)	Catalyst fines
Cycloparafins (C_6-C_9)			
Aromatics (e.g., benzene, toluene xylene)		Ammonia	
Phenols			
Sulfur containing compounds (e.g., mercaptans, thiophenes)			

[a]Source: References 28, 77, 78,79, 80, 81, and 82.

pg. F-30

TABLE F-15 POTENTIAL HAP'S FOR PETROLEUM REFINING INDUSTRIES[a]
(Specific Listing for Petroleum Refining Segment)

	Hazardous Air Pollutants			
	Organic		Inorganic	
Process	Vapor	Particulate	Vapor	Particulate
Crude Separation	a,b,d,e, f,g,h,i, j,k,l,m, o,A,B,C, D,E,F,J	o	c,m,t,u, v,x,y,L	p,I,Q,R
Light Hydrocarbon Processing	g,h,i,n, N,O,P	R	t,v	G,H,Q
Middle and Heavy Distillate Processing	a,d,e,f, g,h,i,j, k,l,F,J, K,O,P,S, T	o,R	m,t,u,v, x,y,L	p,q,G,H, I,Q,U
Residual Hydrocarbon Processing	a,d,e,f, g,h,i,j, k,l,n,F, J,M,N,P, S,T	o,R	m,s,t,u, v,x,y,L	p,q,G,H, I,Q,U
Auxiliary Processes	a,b,d,e, f,g,h,i, j,k,l,n, A,B,C,D, J,K,M,T	o,R	c,m,s,u, y,L	p,q,r,z, I

(continued)

[a] Source: Reference 28. pg. F-30

Pollutant Key (see next page).

TABLE F-15 POTENTIAL HAP'S FOR PETROLEUM REFINING INDUSTRIES[a]
(Specific Listing for Petroleum Refining Segment)
(concluded)

Pollutant Key

a - maleic anhydride
b - benzoic acid
c - chlorides
d - ketones
e - aldehydes
f - heterocyclic compounds (e.g., pyridines)
g - benzene
h - toluene
i - xylene
j - phenols
k - organic compounds containing sulfur (sulfonates, sulfones)
l - cresol
m - inorganic sulfides
n - mercaptans
o - polynuclear compounds (benzo pyrene, anthracene, etc.)
p - vanadium
q - nickel
r - lead
s - sulfuric acid
t - hydrogen sulfide
u - ammonia
v - carbon disulfide
x - carbonyl sulfide
y - cyanides
z - chromates

A - acetic acid
B - formic acid
C - methylethylamine
D - diethylamine
E - thiosulfide
F - methyl mercaptan
G - cobalt
H - molybdenum
I - zinc
J - cresylic acid
K - xylenols
L - thiophenes
M - thiophenol
N - nickel carbonyl
O - tetraethyl lead
P - cobalt carbonyl
Q - catalyst fines
R - coke fines
S - formaldehyde
T - aromatic amines
U - copper

TABLE F-16 EMISSION SOURCES FOR THE PETROLEUM RELATED INDUSTRIES

Source Category	Potential HAP Emission Sources: Process Point	Process Fugitive	Area Fugitive
OIL AND GAS PRODUCTION			
Exploration, Site Preparation and Drilling	A	C	D,E
Crude Processing	G	F,H	
Natural Gas Processing	G,J,K	H	I
Secondary and Tertiary Recovery Techniques	G		I
PETROLEUM REFINING INDUSTRY			
Crude Separation	G,J,L	F,H,M,N	I
Light Hydrocarbon Processing	O,G	F,H	Q
Middle and Heavy Distillate Processing	G,O,P,R	F,H	I
Residual Hydrocarbon Processing	B,G,K,O,R	H	I
Auxiliary Processes	G	F,H	I
BASIC PETROCHEMICALS INDUSTRY			
Olefins Production	G,K,O	F,H	I
Butadiene Production	G,J,L,O,R	F,H,N	I
Benzene/Toluene/Xylene (BTX) Production	G,K,O,R	F,Q	I
Naphthalene Production	G,L,O	F,H	I
Cresol/Cresylic Acids Production	G,L	F,H	
Normal Paraffin Production	G,O	F,H	I

Source Key

A - blowout during drilling
B - visbreaker furnace
C - cuttings
D - drilling fluid
E - pipe leaks (due to corrosion)
F - wastewater disposal (process drain, blowdown, cooling water)
G - flare, incinerator, process heater, boiler
H - storage, transfer, and handling
I - pumps, valves, compressors, fittings, etc.
J - absorber
K - process vent
L - distillation/fractionation
M - hotwells
N - steam ejectors
O - catalyst regeneration
P - evaporation
Q - catalytic cracker
R - stripper

TABLE F-17 POTENTIAL HAP'S FOR COMBUSTION SOURCES

	Hazardous Air Pollutants				
Source Category	Organic		Inorganic		References pg. F-30
	Vapor	Particulate	Vapor	Particulate	
Coal Combustion	n,y,B	s	a,b,h, i,m,q A	a,b,e,f, h,i,j,k,o, p,r,t,v,x	5,22,23,25, 26,27,28,30, 31,32,35,36, 55,74,83,84
Oil Combustion	n	s	m,q,A	a,b,e,f,h, i,j,k,o,p, r,v,x,C	5,22,23,25 26,27,32,35, 36,55,74,83,84
Natural Gas Combustion	n	s			5,23,37,84
Gasoline Combustion	n	s	q	o	5,15,25,35
Diesel Combustion		s		f,r	5,15,35
Wood Combustion	c,d, n,y	s	A	p,t	5,15,25,35
Waste Oil Combustion	g, u,w,z	s		f,h,i,o,r	5,30,83
Municipal Refuse Incineration		s	q,A	f,h,i,k,o, p,r	5,15,22,25,26, 27,29,30,32,36
Sewage Sludge Incineration		s	q	a,f,h,i,o, p,r	5,15,22,25,26 27,30,36,85
PCB Incineration	u	s		D	35,86

Pollutant Key

a - arsenic
b - antimony
c - acetaldehyde
d - acetic acid
e - barium
f - beryllium
g - benzene
h - cadmium
i - chromium
j - cobalt
k - copper

m - fluoride
n - formaldehyde
o - lead
p - manganese
q - mercury
r - nickel
s - polycyclic organic matter (POM)
t - phosphorus
u - polychlorinated biphenyls (PCB)
v - radionuclides
w - trichloroethylene
x - zinc
y - phenol
z - ethyl benzene
A - chlorine
B - pyridine
C - vanadium
D - dibenzofuran

TABLE F-18 EMISSION SOURCES FOR COMBUSTION SOURCES

Source Category	Potential HAP Emission Sources		
	Process Point	Process Fugitive	Area Fugitive
Coal Combustion	A,B	I	H
Oil Combustion	A,B,E		
Natural Gas Combustion	A,B,E,F		
Gasoline Combustion	G		
Diesel Combustion	G		
Wood Combustion	A,B,C		
Waste Oil Combustion	A,B,D		
Municipal Refuse Incineration	D		
Sewage Sludge Incineration	D		
PCB Incineration	D,B		

Source Key

A - furnace
B - boiler
C - woodstove/fireplace
D - incinerator
E - gas turbine
F - reciprocating engine
G - industrial engine and/or equipment
H - coal storage pile
I - ash handling system

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APPENDIX G

POLLUTANT/SOURCE INDEX

APPENDIX G
POLLUTANT/SOURCE INDEX

This appendix contains three pollutant-emission source indices that may be used to identify potential sources of toxic pollutants. Table G-1 addresses point sources, while Tables G-2 and G-3 concern area sources.

The information presented here may be useful to agencies who do not choose to or are not able to use SIC/pollutant and pollutant/SIC indices. The associations presented here are probable or likely, and not definite in all cases. Also, these data do not describe or reflect the quantity of pollutant emitted. Quantities emitted vary from source to source and may range from trace amounts to tons per year.

These data were compiled from references shown on page G-15.

TABLE G-1. EMISSION SOURCE CATEGORIES ASSOCIATED WITH SELECTED TOXIC AIR POLLUTANTS

Pollutant	Potential Emission Sources
Acetaldehyde	Pentaerythritol production Wood combustion
Acrolein	Methionine analogs (poultry feed supplements) production Production of acrylic acid intermediate
Acrylonitrile	Acrylic, modacrylic fiber production Production of ABS and SAN resins Nitrile rubber and latex production Acrylamide production Production of nitrile barrier resins
Aluminum	Aluminum ingot production Aluminum chemicals
Arsenic	End-use in pesticide, herbicides, and fungicides Primary copper and zinc smelting Glass manufacturing Coal combustion Primary and secondary lead smelting Production of chemicals containing arsenic (including insecticides, herbicides, and wood preservatives) Sewage sludge incinerators Gray iron foundries
Aniline	Manufacture of dyes, medicinals, resins, varnishes
Asbestos	Production of asbestos-containing products (including brake linings, shingles and siding, textiles, paper and felt, floor tile, and cement pipe and sheet) Installation of asbestos construction materials Roadway surfacing Building demolition and renovation
Benzene	Automobile exhaust Gasoline evaporation Production of ethylbenzene, styrene, phenol, cyclohexane, maleic anhydride, aniline, chlorobenzenes, nitrobenzene, ethylene, and linear alkyl benzene Solvent usage in textile manufacturing, degreasing, organic synthesis, pharmaceutical synthesis, aluminum alkyls, alcohols, and consumer products
Benzidine	Benzidine production Production of commercial dyes (primarily azo, mordant, and direct dyes) Manufacturing of rubber chemicals End-use of dyes (mainly in textiles, paper, and leather industries)
Benzyl chloride	Quaternary ammonium compounds production
Beryllium	Coal combustion Oil combustion Gray iron foundries Beryllium metal and alloy production Waste incineration Cement production Ceramic plants Rocket motor firings

TABLE G-1. Continued

Pollutant	Potential Emission Sources
Bis (chloromethyl) ether	Anion-exchange resin production Textile manufacturing (segment using formaldehyde-containing reactants and resins in fabric finishing and as adhesives) Nonwoven industry (using thermosetting acrylic emulsion polymers)
1,3-Butadiene	Synthetic rubber manufacture
Cadmium	Iron and steel manufacturing Secondary copper smelting Primary lead smelting Coal combustion Waste and sewage sludge incineration Production of cadmium paint pigments Production of cadmium-barium plastic stabilizers Ni-Cd battery manufacturing Cement production
Carbon disulfide	Paper production Manufacture of rayon, soil disinfectants Solvent for phosphorous, fats, rubber, printing paper, cigarette filter production
Carbon tetrachloride	Miscellaneous solvent applications (as an oil, wax, and fat extractant; in rubber cement; in shoe and furniture polishes; in paints and lacquers; in printing ink; in floor waxes; and in stains) Fluorocarbon gas production (F-11 and F-12) Miscellaneous uses (pharmaceuticals manufacturing pesticide formulation, carbon tetrabromide manufacturing, chlorine production)
Chlorofluorocarbons	Critical cleaning of electrical and mechanical assemblies Solvent applications (primarily degreasing, cleaning and drying) Solder flux removal Dry cleaning Intermediate in refrigerant production
Chlorobenzene	End-use as degreasing solvent (cold cleaners) and intermediate in pesticides manufacturing
Chloroform	Miscellaneous solvent end-uses (manufacturing of artificial silk, plastics, floor polishes, fluorocarbons, dyes, pesticides) Evaporation from pulp/paper bleaching wastewater Pharmaceuticals production Chloroform production Cooling towers
Chloroprene	Chloroprene production and captive use in polychloroprene synthetic rubber manufacturing (neoprene, duprene)
Chromium	Steel production Coal combustion Chromium chemicals production (primarily sodium chromate and sodium dichromate) Oil combustion Waste and sewage sludge incineration Cement production Cooling towers Electroplating

TABLE G-1. Continued

Pollutant	Potential Emission Sources
Cresols	End-use as wire enamel solvent End-uses as disinfectant/cleaning compound, and ore flotation agent Cresol production Cresylic acid production Phenolic resins production Miscellaneous production (BHT, antioxidants, pesticides, tricresyl phosphate)
Dibromoethane (Ethylene dibromide)	Evaporation of leaded automotive fuel End-use as soil and grain fumigant
1,4-Dichlorobenzene (p-Dichlorobenzene)	End-uses as space deodorant and for moth control Pesticide production (as an intermediate) Finishing of woven fabrics
Dichloroethane (Ethylene dichloride)	Ethyleneamines production Evaporation of leaded automotive fuel End-use as an extraction solvent (animal, fats, pharmaceuticals) End-use as a cleaning solvent (plastics, textiles, apparel)
Dichloromethane (Methylene chloride)	Formulation and use of household paint and varnish removers End-use as a metal degreasing solvent (primarily cold cleaners) Aerosol vapor depressant Plastics processing Intermediate in dye and pharmaceutical production Extraction solvent for soils, fats, and waxes
Dimethyl sulfate	Manufacturing of methyl esters, ethers and amines, dyes, drugs, perfume, phenol derivatives, and pesticides Solvent in the separation of mineral oils
Dioxane	Solvent for cellulose acetate, dyes, fats, greases, lacquers, mineral oil, paints, polyvinyl polymers, resins, varnishes, and waxes Paint and varnish stripping Wetting/dispersing agent in textile processing, dye baths, and stain and printing compositions
Dioctyl phthalate	Rubber coating of fabrics
Dimethyl terephthalate	Terephthalic acid production
Epichlorohydrin	Epoxy resin production Epichlorohydrin and glycerin production Production of miscellaneous epichlorohydrin products (polyamide-epichlorohydrin resins, epichlorohydrin elastomers, and surfactants)
Ethylenediamine	Solvent for shellac, casein, and sulfur Stabilizer for rubber latex Textile lubricant
Ethyleneimine (Aziridine)	Textile industry (used for flameproofing, shrink-proofing, stiffening, and waterproofing)

TABLE G-1. Continued

Pollutant	Potential Emission Sources
Ethylene oxide	Production of ethylene glycol, di-, tri-, and polyethylene glycol, surface active agents, and ethanolamines Sterilization of medical apparatus
Fluorides	Fiberglass production
Formaldehyde	Production of urea, phenolic, and melamine resins Production of pentaerythritol, butanediol, acetal resins, and hexamethylenetetramine Formaldehyde production Resin applications (primarily in construction materials industries) End-uses in textile (textile treating), paper, and coating industries) Fuel combustion
Hydrogen sulfide	Manufacture of paper, rayon
Hexachlorocyclopentadiene	Manufacturing of flame retardants, pesticides, and flame-retardant resins
Hexamethylenetetramine	Hexamethylenetetramine production
Hydrazine	Used in chemical synthesis (anticorrosives, dyes, textile agents, pesticides, pharmaceuticals)
Lithium and compounds	Lithium mining, lithium chemical production
Maleic anhydride	Production of phthalic anhydride and unsaturated polyester resins
Manganese	Ferroalloy production Iron and steel production Gray iron foundries Coal combustion Chemical applications and battery production Solid waste and sewage incineration Cooling towers Oil combustion
Mercury	Chloralkali manufacturing Coal combustion Copper and zinc smelting Paint application Incineration
Methyl ethyl ketone	Solvent in surface coating Manufacture colorless synthetic resins
Methyl isobutyl ketone	Solvent for gums, resins
Nickel	Oil combustion (including diesel fuel) Ferroalloys, iron and steel, and non-ferroalloy production Coal combustion Secondary nickel smelting Gray iron foundries Cement productions Cooling towers Municipal and sewage sludge incinerators Electroplating Ni-Cd battery manufacturing

TABLE G-1. Continued

Pollutant	Potential Emission Sources
Nitrobenzene	End-use as solvent in cellulose ether manufacturing (petroleum industry)
N-Nitrosodimethylamine	Uses as intermediate in production of dimethyl formamide and dimethyl acetamide (industrial solvents), lauryl dimethylamine oxide, dimethyl hydrazine pesticides, and rubber chemical accelerators
Nitrosomorpholine	End-use as a corrosion inhibitor in boiler systems Polish and wax formulating Production of rubber processing chemicals Manufacturing of optical brighteners (soap and detergent industry)
Pentachlorophenol	Wood preserving
Phenol	Phenol production Production of phenolic resins Caprolactam and adipic acid production Production of nonylphenol, salicylic acid, and dodecylphenol
Phosgene	Production of toluene diisocyanate, polymeric isocyanates, and polycarbonates
Phosphine	Electronic components manufacture
Polychlorinated biphenyls (PCBs)	Disposal by incineration or burning of transformers and capacitors containing PCBs Transformer leaks
Polycyclic Organic Matter (includes Benzo(a)pyrene)	Residential fuel combustion (primarily wood and coal) Motor vehicles Prescribed burning and wildfires Municipal and industrial incineration Other fuel combustion (burning coal refuse piles, power plants, industrial boilers, catalytic cracking) Carbon black and charcoal production Asphalt production Dye, pigment manufacturing
Radionuclides	Fossil fuel combustion Uranium mining and processing Nuclear fuel fabrication, nuclear reactor operation, and spent fuel reprocessing Elemental phosphorous plants
Styrene	Manufacture of plastics, synthetic rubber, resins
Tetrachloroethylene (Perchloroethylene)	Dry cleaning Textile processing and refinishing Metal cleaning and degreasing (solvent) Miscellaneous chemicals production (intermediate) Miscellaneous solvent applications (magnetic tapes, plastics, rubber solutions, paint removers, inks, solvent soaps, fats, and oils)
Tetrahydrofuran	Solvent for polyvinyl chloride

TABLE G-1. Continued

Pollutant	Potential Emission Sources
Toluene	Automobile exhaust Manufacturing and application of paint and coatings Manufacturing and use of adhesives, inks, and pharmaceuticals Evaporation of gasoline Toluene diisocyanate production Benzoic acid production
1,1,1-Trichloroethane (Methyl chloroform)	Metal cleaning (degreasing) Various other solvent and cleaning applications End-use in aerosol formulations
Trichloroethylene	Metal degreasing (vapor degreasers and cold cleaners) Various other solvent and cleaning applications PVC production
Vinyl chloride	Vinyl chloride and PVC production Ethylene dichloride production
Vinylidene chloride	Production of copolymer coating resins (saran, cellophane, latex) Manufacturing of modacrylic fibers
Xylene	Mixed xylene solvent usage (primarily in paints and coatings) Automobile exhaust Gasoline evaporation Terephthalic acid production

TABLE G-2. AREA SOURCES THAT POTENTIALLY EMIT TOXIC AIR CONTAMINANTS LISTED BY POLLUTANT

Pollutant	Area Source
Acetaldehyde	Slash burning/forest fires Residential wood combustion Industrial wood combustion
Arsenic	Pesticide application Waste oil combustion Industrial coal combustion Residential coal combustion
Asbestos	Wrecking and demolition
Benzene	Petroleum marketing Mobile sources Waste oil combustion Miscellaneous solvent usage Airport operations
Beryllium	Waste oil combustion Industrial oil combustion Industrial coal combustion Residential coal combustion
Cadmium	Waste oil combustion Industrial coal combustion Residential coal combustion
Carbon tetrachloride	Pesticide application Miscellaneous surface coating Miscellaneous solvent usage
Chlorofluorocarbons	Miscellaneous solvent usage Dry cleaners
Chlorobenzene	Miscellaneous solvent usage
Chloroform	Waste oil combustion Miscellaneous solvent usage
Chromium	Waste oil combustion Industrial oil combustion Industrial coal combustion Residential coal combustion

TABLE G-2. Continued

Pollutant	Area Source
Ethylene dibromide	Petroleum marketing Pesticide application Waste oil combustion
1,4-Dichlorobenzene	Pesticide application
Ethylene dichloride	Petroleum marketing Pesticide application Waste oil combustion Miscellaneous solvent usage
Methylene chloride	Waste oil combustion Miscellaneous solvent usage
Dimethyl sulfate	Miscellaneous solvent usage
Dioxane	Miscellaneous solvent usage
Formaldehyde	Industrial wood combustion Industrial oil combustion Industrial coal combustion Slash burning/forest fires Residential wood combustion Residential coal combustion
Manganese	Slash burning/forest fires Waste oil combustion Industrial wood combustion Industrial oil combustion Industrial coal combustion Residential wood combustion Residential coal combustion
Mercury	Waste oil combustion Industrial coal combustion Residential coal combustion
Nickel	Waste oil combustion Industrial oil combustion Industrial coal combustion Residential coal combustion
Phenol	Slash burning/forest fires Industrial wood combustion Residential wood combustion

TABLE G-2. Continued

Pollutant	Area Source
Polychlorinated biphenyls	Waste oil combustion
Polycyclic organic matter	Asphalt distribution and usage
	Mobile sources
	Slash burning/forest fires
	Waste oil combustion
	Industrial wood combustion
	Industrial oil combustion
	Industrial coal combustion
	Residential wood combustion
	Residential coal combustion
	Airport operations
Radionuclides	Mobile sources
	Industrial oil combustion
	Industrial coal combustion
	Residential coal combustion
	Airport operations
Perchloroethylene	Waste oil combustion
	Miscellaneous solvent usage
	Dry-cleaners
Toluene	Asphalt distribution and usage
	Petroleum marketing
	Mobile sources
	Waste oil combustion
	Miscellaneous surface coating
	Miscellaneous solvent usage
	Airport operations
Methyl chloroform	Waste oil combustion
	Miscellaneous solvent usage
Trichloroethylene	Waste oil combustion
	Miscellaneous solvent usage
Xylene	Asphalt distribution and usage
	Petroleum marketing
	Mobile sources
	Waste oil combustion
	Miscellaneous surface coating
	Miscellaneous solvent usage
	Airport operations

TABLE G-3. AREA SOURCES THAT POTENTIALLY EMIT TOXIC AIR POLLUTANTS LISTED BY AREA SOURCE

Area Source	Potential Pollutant(s)
Asphalt distribution and usage	Polycyclic organic matter Toluene Xylene
Petroleum marketing	Benzene Ethylene dibromide Ethylene dichloride Toluene Xylene
Mobile sources (fuel combustion)	Formaldehyde Benzene Polycyclic organic matter Toluene Xylene
Airport operations	Benzene Polycyclic organic matter Toluene Xylene
Pesticide application	Arsenic Carbon tetrachloride 1,4-Dichlorobenzene Ethylene dibromide Ethylene dichloride
Waste oil combustion	Arsenic Benzene Beryllium Cadmium Chloroform Chromium Ethylene dibromide Ethylene dichloride Methylene chloride Manganese Mercury Nickel Polychlorinated biphenyls Polycyclic organic matter

TABLE G-3. Continued

Area Source	Potential Pollutant(s)
Waste oil combustion (continued)	Perchloroethylene Toluene Methyl chloroform Trichloroethylene Xylene
Industrial wood combustion	Acetaldehyde Formaldehyde Manganese Phenol Polycyclic organic matter
Industrial oil combustion	Beryllium Chromium Formaldehyde Manganese Nickel Polycyclic organic matter Radionuclides
Industrial coal combustion	Arsenic Beryllium Cadmium Chromium Formaldehyde Manganese Mercury Nickel Polycyclic organic matter Radionuclides
Residential wood combustion	Acetaldehyde Cresols Formaldehyde Manganese Phenol Polycyclic organic matter
Residential coal combustion	Arsenic Beryllium Cadmium Chromium

TABLE G-3. Continued

Area Source	Potential Pollutant(s)
Residential coal combustion (continued)	Formaldehyde Manganese Mercury Nickel Polycyclic organic matter Radionuclides
Slash burning/forest fires	Acetaldehyde Formaldehyde Manganese Phenol Polycyclic organic matter
Miscellaneous surface coating	Carbon tetrachloride Toluene Xylene
Miscellaneous solvent usage	Benzene Carbon tetrachloride Chlorofluorocarbons Chlorobenzene Chloroform Ethylene dichloride Methylene chloride Dimethyl sulfate Dioxane Perchloroethylene Toluene Methyl chloroform Trichloroethylene Xylene
Dry-cleaners	Chlorofluorocarbons Perchloroethylene
Wrecking and demolition	Asbestos

APPENDIX G REFERENCES

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Radian Corporation, 1985b. Final Work Products Supporting the Development of a Toxic Air Pollutant Regulation for the State of Maryland. July 1985.

APPENDIX H

EMISSION FACTORS FOR TOXIC AIR POLLUTANTS

APPENDIX H

EMISSION FACTORS FOR TOXIC AIR POLLUTANTS

The emission factors listed in Table H were compiled as the result of a contractor literature search to provide preliminary information to support analysis of air toxics problems. The data herein have not been subjected to the EPA or peer review normally provided to such data. These data should not be used for regulatory purposes unless the primary references have been researched and the data are determined to be adequate. The emission factors were chiefly taken from EPA documents such as the "Locating and Estimating Emissions of Pollutant" and "Survey of Pollutant Emission Sources." Because only brief notes concerning the documentation of the factors are given in this appendix, the factors should be used as default values. That is, the factors should be used only when access to the primary literature is not available. No attempt was made to describe the accuracy or validity of the factors.

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS

Pollutant	Process	Emission Factor	Notes	Reference
Acetaldehyde	Wood combustion - residential			
	Woodstove	0.22 lb/ton wood burned		2
	Woodstove	0.24 lb/ton wood burned		3
	Fireplace	1.4 lb/ton wood burned		2
	Wood combustion - commercial, industrial	0.24 lb/ton wood burned		3
Acrylonitrile	Production plant			
	Absorber vent (normal)	0.10 g/kg produced	Uncontrolled	15
		0.002 g/kg produced	Controlled; thermal incinerator. 98% assumed emission reduction.	15
	Absorber vent (startup)	0.187 g/kg produced	Uncontrolled	15
	Column vents	5.00 g/kg produced	Uncontrolled	15
		0.10 g/kg produced	Controlled; flare 98% assumed emission reduction.	15
	Storage vents			
	Crude acrylonitrile	0.048 g/kg produced	Uncontrolled	15
		0.00048 g/kg produced	Controlled; water scrubber. 99% assumed emission reduction.	15
	Acrylonitrile run tanks	0.128 g/kg produced	Uncontrolled	15
		0.00128 g/kg produced	Controlled; water scrubber. 99% assumed emission reduction.	15
	Acrylonitrile storage	0.531 g/kg produced	Uncontrolled	15
		0.00531 g/kg produced	Controlled; water scrubber. 99% assumed emission reduction.	15
	Handling (tank car loading)	0.167 g/kg produced	Uncontrolled	15
		0.0017 g/kg produced	Controlled; water scrubber. 99% assumed emission reduction.	15
	Handling (barge loading)	0.150 g/kg produced	Uncontrolled	15
		0.0011 g/kg produced	Controlled; water scrubber. 99% assumed emission reduction.	15
	Fugitive	0.806 g/kg produced	Uncontrolled	15
		0.238 g/kg produced	Controlled; detection and correction of major leaks. 71% assumed emission reduction.	15

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Arsenic	Mining	0.2 lb/ton of arsenic in ore		8
	Cast iron	0.01 to 0.02 lb/ton of metal charged		8
	Nonferrous alloys	1 lb/ton of arsenic processed		8
	Pesticide production for agricultural uses	20 lb/ton of arsenic processed		8
	Glass production	0.2 lb/ton of glass produced		8
	Wood preservatives	Negligible		8
	Others (paint pigments, pyrotechnics, pharmaceutical, semiconductors, etc.)	3 lb/ton of arsenic processed		8
	Cotton ginning processing	4 lb/10^3 bales of cotton ginned		8
	Foreign residual oil			
	No. 6 fuel oil, Mexico	0.0008 lb/10^3 gallons	0.1 content, ppm	8
	No. 6 fuel oil, Virgin Islands	0.0008 to 0.002 lb/10^3 gallons	0.1 to 0.2 content, ppm	8
	No. 6 fuel oil, Trinidad	0.0007 lb/10^3 gallons	0.095 content, ppm	8
	No. 6 fuel oil, Curacao, N.A.	0.001 to 0.002 lb/10^3 gallons	0.16 to 0.2 content, ppm	8
	Average for foreign residual oil	0.001 lb/10^3 gallons	0.14 content, ppm	8
	Foreign crude oils			
	Neutral zone crude No. 24	0.0006 lb/10^3 gallons	0.079 content, ppm	8
	Boscan crude oil, Morovia	0.002 lb/10^3 gallons	0.34 content, ppm	8
	Jabo crude oil, Venezuela	0.0004 lb/10^3 gallons	0.053 content, ppm	8
	Kuwait crude oil, Kuwait	0.00007 lb/10^3 gallons	0.01 content, ppm	8
	Boscan crude oil, Venezuela	0.02 lb/10^3 gallons	0.31 content, ppm	8
	Lagunillas crude oil, Venezuela	0.0009 lb/10^3 gallons	0.12 content, ppm	8
	UMM Farvo, Libya	0.0001 lb/10^3 gallons	0.02 content, ppm	8
	Average for foreign crude oils	0.0009 lb/10^3 gallons	0.13 content, ppm	8
	U.S. crude oils			
	St. Tedesa, Illinois	0.004 lb/10^3 gallons	0.61 content, ppm	8
	Maysville, W. Oklahoma	0.0002 lb/10^3 gallons	0.031 content, ppm	8
	Hall-Gurney, Kansas	0.0003 lb/10^3 gallons	0.047 content, ppm	8
	East Texas, Texas	0.00005 lb/10^3 gallons	0.007 content, ppm	8
	Grass Creek, Walker Dome, Wyoming	0.0003 lb/10^3 gallons	0.04 content, ppm	8
	Average for U.S. crude oils	0.001 lb/10^3 gallons	0.15 content, ppm	8
	Cotton ginning waste burned	17 lb/10^3 bales of cotton ginned		8
	Sewage and sludge	0.02 lb/ton of sewage and sludge		8

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Arsenic (continued)	Coal combustion-industrial			
	Uncontrolled	0.04 lb/ton		2
	ESP	0.0004 lb/ton		2
	Sewage Sludge Incinerators	0.2-3.9 lb/1000 ton		2
		0.07-7.2 lb/ton		3
	Combustion of bituminous coal-residential	0.4 lb/ton		2
	Waste oil	0.000075-0.0069 lb/1000 gallons		3
	Primary lead smelting	0.88 lb/ton of lead produced		6
	Utility boilers			7
	Bituminous coal			
	Pulverized dry bottom	15.3 pg/J heat input	ESP	7
		5.3 pg/J heat input	Scrubber	7
		133 pg/J heat input	None	7
	Pulverized wet bottom	12.4 pg/J heat input	ESP	7
	Cyclone	3.0 pg/J heat input	ESP	7
	Stoker	206 pg/J heat input	Multicyclones	7
	Anthracite coal			
	Pulverized	15.3 pg/J heat input	ESP	7
	Stoker	206 pg/J heat input	Multicyclones	7
	Lignite coal			
	Pulverized dry bottom	6.8 pg/J heat input	ESP	
	Pulverized wet bottom	5.5 pg/J heat input	ESP	7
	Cyclone	6.7 pg/J heat input	ESP	7
		120 pg/J heat input	Multicyclones	7
	Stoker	206 pg/J heat input	Multicyclones	7
	Residual oil			
	Tangential	9.5 pg/J heat input	ESP	7
		47.3 pg/J heat input	None	7
	Wall	9.5 pg/J heat input	ESP	7
		47.3 pg/J heat input	None	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Arsenic (continued)	Industrial boilers			
	Pulverized	280 pg/J heat input	Multicyclones	7
		92.0 pg/J heat input	Scrubber	7
	Stoker	206 pg/J heat input	Multicyclones	7
		482 pg/J heat input	None	7
	Tangential	9.4 pg/J heat input	Scrubber	7
		47.3 pg/J heat input	None	7
	Wall	9.4 pg/J heat input	Scrubber	7
		47.3 pg/J heat input	None	7
	Commercial boilers			
	Coal	482 pg/J heat input	Stoker	7
	Residual	47.3 pg/J heat input	Tangential	7
	Oil	47.3 pg/J heat input	Wall	7
	Distillate	47.3 pg/J heat input	Tangential	7
	Oil	47.3 pg/J heat input	Wall	7
	Residential			
	Bituminous coal	717 pg/J heat input	All	7
	Anthracite coal	166 pg/J heat input	All	7
	Lignite coal	430 pg/J heat input	All	7
	Distillate coal	1.5 pg/J heat input	All	7
Asbestos	Brake Wear	2.6 ug/km/vehicle		6
	Mining and milling			
	Mining, total	9 to 10 lb/ton mined		8
	Mining	3 lb/ton mined		8
	Loading	2 lb/ton mined		8
	Hauling	2 lb/ton mined		8
	Unloading	2 lb/ton mined		8
	Mining, total, 50% control	5 lb/ton mined		8
	Milling	100 lb/ton milled		8
	Milling, 50% control	80 lb/ton milled		8

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Asbestos (continued)	Milling, 80% control	20 lb/ton milled		8
	Processing			
	Friction material, controlled	6 lb/ton asbestos processed		8
	Asbestos cement products, controlled	1 lb/ton asbestos processed		8
	Textiles	40 lb/ton asbestos processed		8
	Textiles, controlled	2 lb/ton asbestos processed		8
	Asbestos paper	4 lb/ton asbestos processed		8
	Asbestos paper, controlled	1 lb/ton asbestos processed		8
	Floor tile	4 lb/ton asbestos processed		8
	Floor tile, controlled	1 lb/ton asbestos processed		8
Benzene	Petroleum refinery			
	Crude storage/handling	4.7×10^{-3} lb/1000 gal crude		7
	Refinery operations	0.01 lb/1000 gal crude		7
	Benzene production	0.5 lb/1000 gal benzene produced		7
	Gasoline marketing	0.184 lb/1000 gal gasoline		7
Benzo(a)pyrene	Open wood fires	2.5×10^{-4} - 1.4×10^{-3} lb/ton wood burned		3
	Utility boilers			
	Pulverized dry bottom	0.03 pg/J heat input	ESP or multicyclone, bituminous coal	7
	Pulverized wet bottom	0.08 pg/J heat input	ESP or multicyclone, bituminous coal	7
	Cyclone	0.08 pg/J heat input	ESP, bituminous coal	7
	Stoker	0.10 pg/J heat input	Multicyclones, bituminous or anthracite coal	7
	Pulverized dry bottom	0.07 pg/J heat input	ESP, lignite coal	7
	Pulverized wet bottom	0.09 pg/J heat input	Uncontrolled, lignite coal	7
	Cyclone	0.09 pg/J heat input	ESP, lignite coal	7
	Stoker	0.09 pg/J heat input	Multicyclone, lignite coal	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Benzo(a)pyrene (continued)	Tangential	0.002 pg/J heat input	Residual oil, scrubber	7
	Industrial boilers			
	Pulverized	0.03 pg/J heat input	Multicyclone, coal fired	7
	Stoker	0.03 pg/J heat input	Multicyclone, coal fired	7
	Stoker	0.06 pg/J heat input	Uncontrolled, coal fired	7
	Tangential	0.13 pg/J heat input	Uncontrolled, oil fired	7
	Wall	0.2 pg/J heat input	Uncontrolled, oil fired	7
	Commercial boilers			
	Stoker	4.7 pg/J heat input	Uncontrolled, coal fired	7
	Tangential and wall	0.4 pg/J heat input	Uncontrolled, residual oil or distillate oil	7
	Residual boilers			
	All	108 pg/J heat input	Bituminous coal	7
	All	106 pg/J heat input	Anthracite coal	7
	All	108 pg/J heat input	Lignite coal	7
	All	0.1 pg/J heat input	Distillate oil	7
Beryllium	Mining	0.2 lb/ton Be mined		8
	Cement plants			
	Dry process	0.00003 lb/1000 tons produced		8
	Wet process			
	Kiln	0.002 lb/1000 tons produced		8
	Clinker cooler	0.0008 lb/1000 tons produced	ESP	8
	Clinker cooler	0.0009 lb/1000 tons produced	Baghouse	8
	Beryllium alloys (stamped and drawn)	0.1 lb/ton Be processed		8
	Beryllium alloys (molding)	0.01 lb/ton alloy produced	Uncontrolled	8
		0.0004 lb/ton alloy produced	Baghouse	8
	Ceramics	1 lb/ton Be processed	Controlled	8
	Beryllium metal fabrication	0.1 lb/ton of Be processed	Controlled	8
	Oil combustion (residual)	0.0008 lb/10^3 gallons burned		8
	Sewage sludge incineration, multiple hearth	0.0009-0.003 lb/10^3 ton waste	Wet scrubber	8

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Beryllium (continued)	Sewage sludge incineration, fluidized bed	0.0001-0.002 lb/10^3 ton waste	Wet scrubber	8
	Municipal refuse incinerator	0.03 lb/10^3 ton waste	Uncontrolled	8
		0.03 lb/10^3 ton waste	ESP	8
	Gray iron production	0.00044 lb/ton gray iron produced		3
	Waste oil combustion	0.0075 lb/1000 gal		3
	Coal combustion, industrial	0.005 lb/ton	Uncontrolled	2
		0.0001 lb/ton	ESP	2
	Utility boilers			
	Bituminous coal			
	Pulverized dry bottom	2.1 pg/J heat input	ESP	7
		6.9 pg/J heat input	Multicyclone	7
		0.3 pg/J heat input	Scrubber	7
		23.7 pg/J heat input	Uncontrolled	7
	Pulverized wet bottom	1.7 pg/J heat input	ESP	7
		5.6 pg/J heat input	Multicyclone	7
		0.2 pg/J heat input	Scrubber	7
		18.9 pg/J heat input	Uncontrolled	7
	Cyclone	0.6 pg/J heat input	ESP	7
		1.2 pg/J heat input	Multicyclone	7
		0.7 pg/J heat input	Scrubber	7
		4.0 pg/J heat input	Uncontrolled	7
	Stoker	5.6 pg/J heat input	Multicyclone	7
		18.1 pg/J heat input	Uncontrolled	7
	Anthracite coal			
	Pulverized	2.1 pg/J heat input	ESP	7
	Stoker	5.6 pg/J heat input	Multicyclone	7
	Lignite coal			
	Pulverized dry bottom	0.6 pg/J heat input	ESP	7
		0.3 pg/J heat input	Scrubber	7
		64.5 pg/J heat input	Uncontrolled	7
	Pulverized wet bottom	0.5 pg/J heat input	ESP	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Beryllium (continued)	Cyclone	0.3 pg/J heat input	ESP	7
		3.0 pg/J heat input	Multicyclone	7
		0.2 pg/J heat input	Scrubber	7
		55.9 pg/J heat input	Uncontrolled	7
	Residual oil			
	Tangential, wall	0.6 pg/J heat input	ESP	7
		0.002 pg/J heat input	Scrubber	7
		2.3 pg/J heat input	Uncontrolled	7
	Industrial boilers			
	Coal-fired			
	Pulverized	1.9 pg/J heat input	ESP	7
		6.5 pg/J heat input	Multicyclone	7
		1.0 pg/J heat input	Scrubber	7
		21.5 pg/J heat input	Uncontrolled	7
	Stoker	5.6 pg/J heat input	Multicyclone	7
		18.1 pg/J heat input	Uncontrolled	7
	Oil-fired			
	Tangential, wall	0.3 pg/J heat input	Scrubber	7
		1.9 pg/J heat input	Uncontrolled	7
	Commercial boilers			
	Coal-fired			
	Pulverized	9.1 pg/J heat input		7
	Stoker	18.1 pg/J heat input		7
	Residual or distillate oil-fired			
	Tangential, wall	0.1 pg/J heat input		7
	Residual boilers			
	All	7.2 pg/J heat input	Bituminous coal	7
	All	6.6 pg/J heat input	Anthracite coal	7
	All	1.7 pg/J heat input	Lignite coal	7
	All	1.9 pg/J heat input	Distillate oil	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Butyl carbitol	Integrated circuit board manufacture - screening	0.08 ton/100,000 ft^2 product		4
Butyl cellosolve	Integrated circuit board manufacture - developer	0.78 ton/100,000 ft^2 product		4
Cadmium	Mining of zinc bearing ore	0.2 lb/ton Cd mined		8
	Zinc smelting	300 lb/ton Cd charged	Uncontrolled	8
	Copper smelting	1300 lb/ton Cd charged	Not for electrolytic process	8
	Lead smelting	1300 lb/ton Cd charged		8
	Cadmium refining	25 lb/ton Cd produced		8
	Secondary lead - reverberatory furnace	0.1-0.4 lb/ton Pb	Controlled	8
	Steel scrap	0.003 lb/ton steel produced		8
	Secondary lead smelter	4.4×10^{-4} lb/ton lead	Uncontrolled	6
	Cement			
	Dry process	4×10^{-4} lb/ton of feed		6
	Wet process	2×10^{-4} lb/ton of feed		6
	Sewage sludge incineration	0.34 lb/ton waste		6
	Municipal waste incineration	0.009 lb/ton waste		2
	Waste oil combustion	0.003-0.15 lb/1000 gal		3
	Vehicle tire wear	1.07×10^{-8} lb/mile traveled		6
	Industrial boilers			
	Pulverized	2.7 pg/J heat input 0.4 pg/J heat input 8.9 pg/J heat input	Multicyclone, coal-fired Scrubber, coal-fired Uncontrolled, coal-fired	7 7 7
	Stoker	5.5 pg/J heat input 17.9 pg/J heat input	Multicyclone, coal-fired Uncontrolled, coal-fired	7 7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Cadmium (continued)	Tangential, wall	21.0 pg/J heat input	Scrubber, oil-fired	7
		71.3 pg/J heat input	Uncontrolled, oil-fired	7
	Commercial boilers			
	Stoker	12.9 pg/J heat input	Uncontrolled, coal-fired	7
	Tangential, wall	71.8 pg/J heat input	Uncontrolled, oil-fired	7
	Residual boilers			
	All	17.9 pg/J heat input	Bituminous coal	7
	All	6.6 pg/J heat input	Anthracite coal	7
	All	1.7 pg/J heat input	Lignite coal	7
	All	11.0 pg/J heat input	Distillate oil	7
	Utility boilers			
	Pulverized dry bottom	0.8 pg/J heat input	Multicyclone, bituminous coal	7
		1.7 pg/J heat input	Uncontrolled, bituminous coal	7
	Pulverized wet bottom	8.9 pg/J heat input	ESP, bituminous coal	7
		0.6 pg/J heat input	Multicyclone, bituminous coal	7
	Cyclone	0.3 pg/J heat input	Multicyclone, bituminous coal	7
	Stoker	5.5 pg/J heat input	Uncontrolled, bituminous coal	7
		0.8 pg/J heat input	Multicyclone, anthracite coal	7
	Pulverized dry bottom	5.5 pg/J heat input	ESP, lignite coal	7
		0.3 pg/J heat input	Multicyclone, lignite coal	7
		15.1 pg/J heat input	Scrubber, lignite coal	7
	Pulverized wet bottom	0.3 pg/J heat input	Multicyclone, lignite coal	7
	Cyclone	0.7 pg/J heat input	Multicyclone, lignite coal	7
		9.8 pg/J heat input	Scrubber, lignite coal	7
	Stoker	5.5 pg/J heat input	Uncontrolled, lignite coal	7
	Tangential, wall	14.4 pg/J heat input	Scrubber, residual oil	7
		71.8 pg/J heat input	Uncontrolled, residual oil	7
Carbon tetrachloride	Carbon tetrachloride production -			
	Hydrocarbon chlorinolysis:			
	Distillation column	0.008 kg/Mg produced	Uncontrolled	16

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Carbon tetrachloride (continued)	Storage	0.098-0.58 kg/Mg produced 0.013-0.087 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16
	Tank truck/car loading	0.24 kg/Mg produced 0.036 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16
	Waste handling	0.0046 kg/Mg produced 4.6×10^{-5} kg/Mg produced	Uncontrolled Vapor balance and refrigerated condenser	16 16
	Waste caustic	0.0029 kg/Mg produced 1.2×10^{-4} kg/Mg produced	Uncontrolled Steam stripper	16 16
	Process fugitive	1.5 kg/hr produced 0.41-0.78 kg/hr produced	Uncontrolled Monthly inspection/maintenance, double mechanical seals	16 16
	Carbon tetrachloride production -			
	Methane chlorination process:			
	Recycled methane inert gas purge vent	0.042 kg/Mg produced	Uncontrolled	16
	Distillation area emergency inert gas vent	0.052 kg/Mg produced	Uncontrolled	16
	Storage	0.057-0.64 kg/Mg produced 0.0046-0.096 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16
	Handling	0.24 kg/Mg produced 0.036 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16
	Process fugitives	2.56 kg/hr 0.74-1.6 kg/hr	Uncontrolled Monthly inspection/maintenance, double mechanical seals	16 16
	Carbon tetrachloride production -			
	Carbon disulfide chlorination process:			
	Chlorinator	116 kg/Mg produced 5.8 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16
	Storage	0.76 kg/Mg produced 0.11 kg/Mg produced	Uncontrolled Refrigerated condenser	16 16

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Carbon tetrachloride (continued)	Handling	0.24 kg/Mg produced	Uncontrolled	16
		0.036 kg/Mg produced	Refrigerated condenser	16
	Process fugitives	0.60 kg/hr	Uncontrolled	16
		0.14-0.32 kg/hr	Inspection/maintenance, double mechanical seals	16
	Carbon tetrachloride production -			
	Methanol hydrochlorination/methyl chloride chlorination process:			
	Storage	0.040-1.39 kg/Mg	Uncontrolled	16
		0.0012-0.21 kg/Mg	Refrigerated condenser	16
	Handling	0.52 kg/Mg	Uncontrolled	16
		0.078 kg/Mg	Refrigerated condenser	16
	Process fugitives	0.48 kg/Mg	Uncontrolled	16
		0.091-0.28 kg/Mg	Controlled	16
	Fluorocarbon 11 and 12 production:			
	Reactor venting	0.042 kg/Mg produced	Uncontrolled	16
	Distillation column	0.023 kg/Mg produced	Refrigerated condenser and scrubber	16
	Storage	0.19-0.74 kg/Mg produced	Uncontrolled	16
		0.029-0.11 kg/Mg produced	Refrigerated condenser	16
	Pharmaceutical production	110 kg/Mg CCl_4 used	Controlled	16
	Ethylene dichloride production -			
	Balanced process:			
	Oxychlorination vent			
	Air process	0.29-1.2 kg/Mg produced	Uncontrolled	16
		$5.8 \times 10^{-3} - 2.4 \times 10^{-2}$ kg/Mg produced	Thermal oxidizer	16
	Oxygen process	0.044-0.18 kg/Mg produced	Uncontrolled	16
		$8.8 \times 10^{-4} - 3.6 \times 10^{-3}$ kg/Mg produced	Thermal oxidizer	16
	Column vents	0.14 kg/Mg produced	Uncontrolled	16
		2.8×10^{-3} kg/Mg produced	Thermal oxidizer	16
	Liquid waste storage	0.0051 kg/Mg produced	Uncontrolled	16
		7.7×10^{-4} kg/Mg produced	Refrigerated condenser	16

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Carbon tetrachloride (continued)	Perchloroethylene production -			
	Ethylene dichloride chlorination			
	Neutralization	0.016 kg/Mg produced	Uncontrolled	16
	Drying column	0.063 kg/Mg produced 0.005 kg/Mg produced	Uncontrolled Condenser	16 16
	Distillation column	0.027 kg/Mg produced	Uncontrolled	16
	Light ends/heavy ends mix tank	0.039 kg/Mg produced 0.022 kg/Mg produced	Uncontrolled Condenser	16 16
	Storage - light ends	0.11 kg/Mg produced 0.0012 kg/Mg produced	Uncontrolled Condenser	16 16
	Process fugitive	2.8 kg/hr	Uncontrolled	16
Chloroform	Waste oil combustion	0.03-0.53 lb/1000 gal		3
	Chloroform production -			
	Methanol hydrochlorination/methyl chloride chlorination process:			
	Chloroform distillation vent	0.022 kg/Mg produced	Uncontrolled	17
	Storage	0.061-0.97 kg/Mg produced	Uncontrolled	17
	Handling	0.35 kg/Mg produced 0.035 kg/Mg produced	Uncontrolled Condenser	17 17
	Process fugitive	1.4 kg/hr 0.32 kg/hr	Uncontrolled Controlled	17 17
	Methane chlorination process:			
	Recycled methane inert gas purge vent	0.013 kg/Mg produced	Uncontrolled	17
	Distillation area emergency inert gas vent	0.032 kg/Mg produced	Uncontrolled	17
	Storage	0.088-0.83 kg/Mg produced 0.073 kg/Mg produced	Uncontrolled Controlled	17 17

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chloroform (continued)	Secondary	0.21 kg/Mg produced	Uncontrolled	17
	Handling	0.35 kg/Mg produced	Uncontrolled	17
		0.035 kg/Mg produced	Condenser	17
	Process fugitive	3.1 kg/hr	Uncontrolled	17
		0.74 kg/hr	Controlled	17
	Fluorocarbon 22 production -			
	Storage	0.59-2.5 kg/Mg produced	Uncontrolled	17
		0.03-0.125 kg/Mg produced	Refrigerated condenser	17
	Fugitive	0.023 kg/hr	Controlled	17
	Ethylene dichloride production by balanced process -			
	Oxychlorination vent:			
	Air process	0.033-0.65 kg/Mg produced	Uncontrolled	17
		$6.6 \times 10^{-4} - 1.3 \times 10^{-7}$ kg/Mg produced	Thermal oxidizer	17
	Oxygen process	0.005-0.12 kg/Mg produced	Uncontrolled	17
		$1.0 \times 10^{-4} - 2.4 \times 10^{-3}$ kg/Mg	Thermal oxidizer	17
	Column vents	1.0 kg/Mg produced	Uncontrolled	17
		0.02 kg/Mg produced	Thermal oxidizer	17
	Liquid waste storage	0.003 kg/Mg produced	Uncontrolled	17
		4.5×10^{-4} kg/Mg produced	Refrigerated condenser	17
	Pulp/paper mills -			
	Integrated mills:			
	Dissolving kraft pulp	0.12 kg/Mg produced	During wastewater treatment	10
		0.013 kg/Mg produced	After wastewater treatment	10
	Market bleached kraft pulp	0.22 kg/Mg produced	During wastewater treatment	10
		0.0019 kg/Mg produced	After wastewater treatment	10
	Bleached kraft paperboard, coarse paper, tissue paper	0.22 kg/Mg produced	During wastewater treatment	10
		0.00090 kg/Mg produced	After wastewater treatment	10
	Soda and kraft fine bleached papers	0.13 kg/Mg produced	During wastewater treatment	10
		0.0059 kg/Mg produced	After wastewater treatment	10

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chloroform (continued)	Dissolving sulfite pulp	0.069 kg/Mg produced	During wastewater treatment	10
		0.0035 kg/Mg produced	After wastewater treatment	10
	Sulfite papergrade pulp	0.38 kg/Mg produced	During wastewater treatment	10
		0.074 kg/Mg produced	After wastewater treatment	10
	Pulp/paper mills:			
	Secondary fiber mills			
	Deink - fine paper	0.36 kg/Mg produced	During wastewater treatment	10
		0.013 kg/Mg produced	After wastewater treatment	10
	Deink - tissue paper	0.16 kg/Mg produced	During wastewater treatment	10
		0.0067 kg/Mg produced	After wastewater treatment	10
	Pharmaceutical manufacture	160 kg/Mg used	Controlled	11
	Cooling tower	0.41 kg/10^9 l	Uncontrolled	11
	Drinking water	0.041 kg/10^6 l treated	Uncontrolled	11
	Municipal wastewater	0.014 kg/10^6 l discharged	Uncontrolled	11
	Sludge	580 kg/10^6 Mg treated by super chlorination	Uncontrolled	11
Chromium	Chromite ore refining		Factor reported as total elemental chromium.	
	Chromite ore dryer	0.009 lb/ton of chromite ore processed	Bag collector	9
		0.002 lb/ton of chromite ore processed	Wet scrubber; 99.9% control efficiency	9
	Harding mill and cyclone	0.005 lb/ton of chromite ore processed	Fabric filter	9
	Refined ore storage	0.09 lb/ton of chromite ore processed	Uncontrolled	9
		0.00009 lb/ton of chromite ore processed	Dust collector (filter cartridge)	9
	Processing of raw materials at ferrochrome plants -		Factors expressed as total elmental chromium.	
	Receipt and storage of chrome ore in stock pile	0.68 lb/ton of chrome ore processed	15% of sources used to develop this factor were controlled.	9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Drying, crushing, and sizing of chrome ore	0.68 lb/ton of chrome ore processed	75% of sources used to develop this factor were controlled.	9
	Weighing and feeding chrome ore to electric arc furnace	0.61 lb/ton of chrome ore processed	20% of sources used to develop this factor were controlled.	9
	Electric arc furnaces used to produce ferrochromes -			
	Ferrochrome - silicon	3.3-12 lb/ton of product 0.45-1.6 lb/MW-hr	Uncontrollled; assumes chromium is 0.4 to 1.4% of total particulate emissions by weight.	9
	High-carbon ferrochrome and charge chrome	47 lb/ton of product 8.7 lb/MW-hr	Uncontrolled; assumes chromium is 14% of total particulate emissions by weight.	9
	Chrome ore/lime melt	1.6 lb/ton of product 1.4 lb/MW-hr	Uncontrolled; assumes chromium is 15% of total particulate emissions by weight.	9
	Ferrochrome - silicon	0.0076 lb/MW-hr	Controlled; assumes chromium is 0.4% of total controlled particulate emissions by weight.	
	Ferrochrome - silicon	0.0018 lb/MW-hr	Controlled; assumes chromium is 0.4% of total controlled particulate emissions by weight.	
	Ferrochrome - silicon	0.0017 lb/MW-hr	Controlled; assumes chromium is 0.4% of total controlled particulate emissions by weight.	
	Ferrochrome - silicon	0.00004 lb/MW-hr	Controlled; assumes chromium is 0.4% of total controlled particulate emissions by weight.	
	High-carbon ferrochrome and charge chrome	0.15 lb/MW-hr	Controlled; assumes chromium is 14% of total particulate emissions by weight.	
	High-carbon ferrochrome	0.0049 lb/MW-hr	Controlled; assumes chromium is 14% of total particulate emissions by weight.	
	High-carbon ferrochrome	0.091 lb/MW-hr	Controlled; assumes chromium is 14% of total particulate emissions by weight.	
	High-carbon ferrochrome	0.38 lb/ton of product 0.090 lb/MW-hr	Controlled; assumes chromium is 14% of total particulate emissions by weight.	

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	High-carbon ferrochrome	0.045 lb/MW-hr	Controlled; assumes chromium is 14% of total particulate emissions by weight.	
	Finishing operations and product handling at ferrochrome plants -		Factors expressed as total elemental chromium.	
	Treatment of molten alloy with chlorine or other gas in ladle:		25% of sources used to determine factors were controlled.	
	Ferrochrome - silicon High-carbon ferrochrome	3.4 lb/ton of product 6.6 lb/ton of product		9 9
	Casting of ferrochrome product:		42% of sources used to determine factors were controlled.	
	Ferrochrome - silicon High-carbon ferrochrome	0.072 lb/ton of product 0.14 lb/ton of product		9 9
	Crushing/Grinding of product:		93% of sources used to determine factors were controlled.	
	Ferrochrome - silicon High-carbon ferrochrome	0.22 lb/ton of product 0.42 lb/ton of product		9 9
	Refractory industry -		Factors expressed as total elemental chromium.	
	Total pressing process	150 lb/ton of refractory produced, 54 lb/ton of refractory produced	Uncontrolled Controlled; 64% control efficiency	9 9
	Ore crushing, sizing, drying	150 lb/ton of refractory produced, 54 lb/ton of refractory produced	Uncontrolled Controlled; 64% control efficiency	9 9
	Brick firing kilns	0.2 lb/ton of refractory produced	Uncontrolled	9
	Total fusion casting process	225 lb/ton of refractory produced, 52 lb/ton of refractory produced	Uncontrolled Controlled; 77% control efficiency	9 9
	Ore crushing, sizing, drying	150 lb/ton of refractory produced, 34 lb/ton of refractory produced	Uncontrolled Controlled; 77% control efficiency	9 9
	Fusion melting, casting, breakout, and finishing	75 lb/ton of refractory produced, 18 lb/ton of refractory produced	Uncontrolled Controlled; 77% control efficiency	9 9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Refractory industry -		Factors reported as total elemental chromium.	
	Chrome-magnesite brick production:			
	Chrome Ore Preparation			
	Ore storage, grinding, and sizing (chrome ore)	0.02-0.10 lb/ton of raw materials processed	Fabric filter; 99.9% control efficiency.	9
	Dryer (chrome ore)	0.0035-0.0041 lb/ton of raw materials processed	Fabric filter; 99.9% control efficiency.	9
	Storage in raw materials silo (chrome ore and magnesite)	0.0045-0.0065 lb/ton of raw materials processed	Fabric filter; 99.9% control efficiency.	9
	Processing and Firing			
	Mixer (chrome ore and magnesite)	0.0011-0.0043 lb/ton of raw materials processed	Fabric filter; 99.9% control efficiency.	9
	Brick dryer (chrome ore and magnesite)	0.00074 lb/ton of raw materials processed	Scrubber; 90% control efficiency.	9
	Brick kiln (chrome ore and magnesite)	0.00099 lb/ton of raw materials processed	Scrubber; 90% control efficiency.	9
	Chrome oxide brick production:			
	Casting Process			
	Milling (ball mill) (chromic oxide)	0.96 lb/ton of raw materials processed	Wet scrubber; 97% control efficiency.	9
	Spray dryer (chromic oxide)	0.96 lb/ton of raw materials processed	Fabric filter; 97% control efficiency.	9
	Pressing Process			
	Mixer (chromic oxide)	0.96 lb/ton of raw materials processed	Wet scrubber; 97% control efficiency.	9
	Sodium dichromate manufacturing plants -		Factors expressed as total elemental chromium.	
	Total process	30 lb/ton of dichromate produced	Uncontrolled	9
		3.0 lb/ton of dichromate produced	Controlled; 90% control efficiency	9
	Kiln only	15 lb/ton of dichromate produced	Uncontrolled	9
		1.5 lb/ton of dichromate produced	Controlled; 90% control efficiency	9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Chromic acid production			
	Chromic acid reactor, melter, and flaker	0.4 lb/ton of raw materials processed	Uncontrolled	9
		0.02 lb/ton of raw materials processed	Controlled; scrubber; 95% control efficiency.	
	Chromic acid filter	2.8 lb/ton of raw materials processed	Uncontrolled	9
		0.03 lb/ton of raw materials processed	Controlled; scrubber; 99% control efficiency.	9
	Packaging	1.4 lb/ton of raw materials processed	Uncontrolled	9
		0.07 lb/ton of raw materials processed	Controlled; scrubber; 95% control efficiency.	9
	Hard chromium plating facility		Factors are in terms of chromic acid and are from one facility. All chromium is in the hexavalent form.	
	Hard plating tank	0.000054-0.00029 lb/hr.ft^2 of tank area		9
	Chromic acid anodizing tank	0.0019 lb/hr.ft^2 of tank area		9
	Electric arc furnaces (EAF's)		Factors as total elemental chromium and represent emissions after capture equipment but prior to controls.	
	Stainless steel and special alloys	1.6-4.8 lb/ton of steel produced		9
	Mixed products including stainless steel and/or specialty alloys	0.33-1.0 lb/ton of steel produced		9
	Carbon and alloy steel	0.03-0.09 lb/ton of steel produced		9
	Carbon steel	0.03-0.09 lb/ton of steel produced		9
	Argon-oxygen decarburization vessels (AOD's)			
	Stainless and specialty alloys	0.87-1.2 lb/ton of steel produced		9
	Oil combustion		Chromium emissions most likely to exist as chromium sulfate, complex oxides of chromium and other metals, and chromium oxide.	

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Distillate #2	23.8-29 pg/J (chromium emitted per unit of heat energy contained in the fuel)	Uncontrolled; measured	9
	Distillate #2	1.1-55 pg/J (chromium emitted per unit of heat energy contained in the fuel)	Uncontrolled; calculated	9
	Distillate #2	0.32-0.35 lb/10^6 gal (chromium emitted per mass of oil fired)	Uncontrolled; measured	9
	Residual #4	0.29 lb/10^6 gal (chromium emitted per mass of oil fired)	Uncontrolled; measured	9
	Residual #5	0.69 lb/10^6 gal (chromium emitted per mass of oil fired)	Uncontrolled; measured	9
	Residual #6	3.4 lb/10^6 gal (chromium emitted per mass of oil fired)	Uncontrolled; measured	9
	Residual	28.6 pg/J (chromium emitted per unit of heat energy contained in the fuel)	Uncontrolled; measured	9
	Residual	2.1-50 pg/J (chromium emitted per unit of heat energy contained in the fuel)	Uncontrolled; calculated	9
	Residual	5.7 pg/J (chromium emitted per unit of heat energy contained in the fuel)	Controlled; wet scrubber or ESP	9
	Coal combustion		Factors expressed as total chromium emitted per unit of heat energy in the fuel. Emissions most likely to exist as chromium sulfate, complex oxides of chromium and other metals, and chromium oxide.	
	Stoker; anthracite coal	102 - 648 pg/J heat input	Uncontrolled; measured	9
	Stoker; anthracite coal	200 pg/J heat input	Uncontrolled; calculated	9
	Stoker; anthracite coal	16.3 pg/J heat input	MC; calculated	9
	Pulverized; anthracite coal	60.2 pg/J heat input	ESP; calculated	9
	Pulverized; bituminous coal	1505 - 2600 pg/J heat input	Uncontrolled; calculated	9
	Pulverized; bituminous coal	825 pg/J heat input	Uncontrolled; measured	9
	Pulverized; bituminous coal	71.8 - 770 pg/J heat input	MC; calculated	9
	Pulverized; bituminous coal	5.3 pg/J heat input	MC; measured	9
	Pulverized; bituminous coal	45 - 60.2 pg/J heat input	ESP; calculated	9
	Pulverized; bituminous coal	2.5 - 3430 pg/J heat input	ESP; measured	9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Pulverized; bituminous coal	54.2 - 170 pg/J heat input	WS; calculated	9
	Pulverized; bituminous coal	0.26 - 5.3 pg/J heat input	WS; measured	9
	Pulverized; bituminous coal	7.8 pg/J heat input	MC/WS; measured	9
	Pulverized; bituminous coal	54 pg/J heat input	FGD; measured	9
	Cyclone; bituminous coal	495 - 645 pg/J heat input	Uncontrolled; measured	9
	Cyclone; bituminous coal	130 pg/J heat input	MC; calculated	9
	Cyclone; bituminous coal	8 - 9.3 pg/J heat input	ESP; calculated	9
	Cyclone; bituminous coal	290 - 2300 pg/J heat input	ESP; measured	9
	Cyclone; bituminous coal	14 pg/J heat input	WS; calculated	9
	Cyclone; bituminous coal	46 pg/J heat input	WS; measured	9
	Stoker; bituminous coal	38.3 - 2000 pg/J heat input	Uncontrolled; calculated	9
	Stoker; bituminous coal	8.1 - 129 pg/J heat input	Uncontrolled; measured	9
	Stoker; bituminous coal	16.3 - 590 pg/J heat input	MC; calculated	9
	Stoker; bituminous coal	26.8 - 1040 pg/J heat input	MC; measured	9
	Stoker; bituminous coal	58 pg/J heat input	ESP; measured	9
	Stoker; bituminous coal	66 pg/J heat input	FF; measured	
	Pulverized; lignite coal	253 pg/J heat input	MC; calculated	9
	Pulverized; lignite coal	29 - 32 pg/J heat input	MC; measured	9
	Pulverized; lignite coal	9.2 - 26.5 pg/J heat input	ESP; calculated	9
	Pulverized; lignite coal	8.6 pg/J heat input	ESP; measured	9
	Pulverized; lignite coal	75 pg/J heat input	WS; calculated	9
	Cyclone; lignite coal	245 - 430 pg/J heat input	MC; calculated	9
	Cyclone; lignite coal	5 - 17.8 pg/J heat input	ESP; calculated	9
	Cyclone; lignite coal	<3.3 pg/J heat input	ESP; measured	9
	Cyclone; lignite coal	40 pg/J heat input	WS; calculated	9
	Stoker; lignite coal	16.3 pg/J heat input	MC; calculated	9
	Stoker; lignite coal	13 pg/J heat input	MC; measured	9
	Stoker; lignite coal	<2.3 pg/J heat input	ESP; measured	9
	Cement Plants		Factors expressed as total chromium and in terms of the amount of cement produced.	
	Dry process kiln	26 lb/1000 tons	Uncontrolled	9
		0.004 - 0.03 lb/1000 tons	ESP	9
		0.003 - 0.03 lb/1000 tons	Fabric filter	9
	Dryers and grinders	10 lb/1000 tons	Uncontrolled	9
	Wet process kiln	25 lb/1000 tons	Uncontrolled	9
		0.004 - 0.03 lb/1000 tons	ESP	9
		0.01 - 0.03 lb/1000 tons	Fabric filter	9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Dryers and grinders	3.4 lb/1000 tons	Uncontrolled	9
	Clinker cooler	0.001 - 0.014 lb/1000 tons	Fabric filter	9
		0.005 - 0.01 lb/1000 tons	Gravel bed	9
		0.005 lb/1000 tons	Wet scrubber	9
	Municipal refuse incinerators		Factors expressed as total elemental chromium.	
	Multiple hearth			
	Refuse only	0.0077 lb/ton solid waste incinerated	Wet scrubber	9
	Refuse and sludge	0.0091 lb/ton solid waste incinerated	Wet scrubber	9
	Rocking grate	0.0048 lb/ton solid waste incinerated	Wet scrubber	9
	Travelling grate	0.0006 lb/ton solid waste incinerated	ESP	9
	Sewage sludge incinerators			
	Fluidized-bed 704°C	0.00008 lb/ton solid waste incinerated	Wet scrubber	
	816°C	0.00006 lb/ton solid waste incinerated	Wet scrubber	
	927°C	0.0004 lb/ton solid waste incinerated	Wet scrubber	
	Fluidized-bed	0.0006 lb/ton solid waste incinerated	Wet scrubber	
	Multiple hearth	0.014 lb/ton solid waste incinerated	Two controlled by wet scrubbers, one by a single-pass cyclonic scrubber.	
	Wood combustion	0.76 - 11.7 pg/J		9
	Fresh water utility cooling towers		Factors expressed as weight of pollutant per thermal energy input to the power plant associated with the cooling tower. Emissions expressed as total chromium.	
	Drift loss range of 0.1 to 0.2% (fraction of recirculating water emitted by design as draft)	2.5 pg/J		9
	Drift loss range of 0.002 to 0.005%	0.06 pg/J		9
	Asbestos mining and milling		Factors reported as total elemental chromium.	
	Mining and milling	0.14 lb/ton of asbestos produced	Degree of control unspecified	9

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Mining	0.015 lb/ton of asbestos produced	Uncontrolled	9
		0.008 lb/ton of asbestos produced	50% controlled	9
		0.003 lb/ton of asbestos produced	80% controlled	9
	Milling	0.15 lb/ton of asbestos produced	Uncontrolled	9
		0.03 lb/ton of asbestos produced	80% controlled	9
		0.0015 lb/ton of asbestos produced	99% controlled	9
		0.000015 lb/ton of asbestos produced	Controlled	9
	Oil combustion, commercial and industrial	0.007 lb/1000 gal	Uncontrolled	2
	Utility cooling towers			
	Pre-1970	0.51 lb/MW output		2
	Post-1970	0.012 lb/MW output		2
	Bituminous coal combustion residential	0.004 lb/ton		2
	Residual oil combustion	1.2 E - 3 lb/ton burned		6
	Coal combustion, utility boilers			
	Pulverized dry bottom - bituminous coal	60.3 pg/J heat input	ESP	7
		170 pg/J heat input	Scrubber	7
		1505 pg/J heat input	Uncontrolled	7
	Pulverized wet bottom - bituminous coal	49 pg/J heat input	ESP	7
		80 pg/J heat input	ESP	7
	Cyclone - bituminous coal	46 pg/J heat input	Scrubber	7
	Stoker - bituminous coal	16.3 pg/J heat input	Multicyclones	7
	Pulverized - anthracite	60.2 pg/J heat input	ESP	7
	Stoker - anthracite	16.3 pg/J heat input	Multicyclones	7
	Pulverized dry bottom - lignite	26.5 pg/J heat input	ESP	7
	Pulverized wet bottom - lignite	3.2 pg/J heat input	Multicyclones	7
		21.6 pg/J heat input	ESP	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Cyclone - lignite	17.8 pg/J heat input	ESP	7
		430 pg/J	Multicyclones	7
		2.1 pg/J	Scrubber	7
	Stoker - lignite	16.3 pg/J	Multicyclones	7
	Residual oil combustion			
	Tangential	5.7 pg/J	ESP	7
		28.6 pg/J	Uncontrolled	7
	Wall	5.7 pg/J	ESP	7
		28.6 pg/J	Uncontrolled	7
	Coal combustion - industrial boilers			
	Pulverized	71.3 pg/J heat input	Multicyclones	7
		54.2 pg/J heat input	Scrubber	7
	Stoker	16.3 pg/J heat input	Multicyclones	7
		38.3 pg/J heat input	Uncontrolled	7
	Oil combustion - industrial boilers			
	Tangential	5.7 pg/J heat input	Scrubber	7
		28.6 pg/J heat input	Uncontrolled	7
	Wall	5.7 pg/J heat input	Scrubber	7
		28.6 pg/J heat input	Uncontrolled	7
	Coal combustion - commercial boilers			
	Stoker	38.3 pg/J heat input	Uncontrolled	7
	Oil combustion - commercial boilers			
	Tangential - residual oil	50.0 pg/J heat input	Uncontrolled	7
	Wall - residual oil	50.0 pg/J heat input	Uncontrolled	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Chromium (continued)	Oil combustion - commercial boilers -			
	Tangential - distillate oil	50.0 pg/J heat input	Uncontrolled	7
	Wall - distillate oil	50.0 pg/J heat input	Uncontrolled	7
	Coal combustion - residential boilers -			
	All furnace types - bituminous coal	71.3 pg/J heat input	Uncontrolled	7
	All furnace types - anthracite	66.2 pg/J heat input	Uncontrolled	7
	All furnace types - lignite	17.2 pg/J heat input	Uncontrolled	7
	Oil combustion - residential boilers -			
	All furnace types - distillate oil	1.1 pg/J heat input	Uncontrolled	7
Cresols	Coke production	0.048 lb/ton of coke produced		2
	Cresylic acid production -			
	Process	0.00190 lb/lb used		3
	Storage	0.00020 lb/lb used		3
	Fugitive	0.00040 lb/lb used		3
	Cresol production -			
	Process	0.00190 lb/lb used		3
	Storage	0.00020 lb/lb used		3
	Fugitive	0.00040 lb/lb used		3
Dichloroethane	Ethyl chloride production	9.45 kg/Mg produced		2
	Waste oil combustion	0.045 - 6.33 lb/1000 gal burned		3
Dichloromethane	Waste oil combustion	0.03 - 12.6 lb/1000 gal	Waste oil burned	3
Dipropylene glycol	Integrated circuit board manufacture	0.09 tons/100,000 ft^2 product		4
DMF	Integrated circuit board manufacture -			
	Screening-hardener	0.04 tons/100,000 ft^2 product		4

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Epichlorohydrin	Epichlorohydrin production -			
	Process vents	0.00047 g/kg produced	Controlled, not necessarily representative of emission rates from any particulate facility.	22
	Storage facilities	0.15 g/kg produced	Includes emissions from glycerin manufacture.	22
	Fugitive sources	0.62 g/kg produced	Valves, pumps, seals, uncontrolled	22
	Resin, elastomer and surfactant production, batch processes using epichlorohydrin as feedstock -			
	Process vents	0.56 g/kg produced	Not representative of emission rates at any particular facility	22
	Storage facilities	0.47 g/kg produced	Includes transfer operations	22
	Fugitive sources	7.10 g/kg produced	Pump seals, valves, compressors, flanges	22
Ethylene dibromide	Waste oil combustion	0.038 - 0.053 lb/1000 gal	Waste oil burned	3
Ethylene dichloride	EDC production, oxychlorination - air process			
	Absorber/stripper	3.24 kg/Mg produced	Uncontrolled	13
		0.0658 kg/Mg produced	Thermal oxidizer	13
		0.250 kg/Mg produced	Catalytic oxidizer	13
	Refrigerated condenser	2.40 kg/Mg produced	Uncontrolled	13
		0.0480 kg/Mg produced	Thermal oxidizer	13
	EDC production, oxychlorination -			
	Oxygen process	0.462 kg/Mg produced	Uncontrolled	13
		0.0092 kg/Mg produced	Thermal oxidizer	13
	EDC production, direct			
	Chlorination vent	1.08 kg/Mg produced	Uncontrolled	13
		0.0216 kg/Mg produced	Thermal oxidizer	13
		0.162 kg/Mg produced	Refrigerated condenser	13
	Column vents	3.00 kg/Mg produced	Uncontrolled	13
		0.0600 kg/Mg produced	Thermal oxidizer	13

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Ethylene dichloride (continued)	Storage vents - in process	0.0149 kg/Mg produced	Uncontrolled	13
		0.0003 kg/Mg produced	Thermal oxidizer	13
		0.0022 kg/Mg produced	Refrigerated condenser	13
	Storage vents - product	0.0733 kg/Mg produced	Uncontrolled	13
		0.0015 kg/Mg produced	Thermal oxidizer	13
		0.0110 kg/Mg produced	Refrigerated condenser	13
	Process fugitives	0.265 kg/Mg produced	Uncontrolled	13
		0.106 kg/Mg produced	Leak correction	13
	Vinyl chloride monomer production -			
	Heavy ends stream	0.6 - 0.8 kg/Mg produced	Uncontrolled	13
		0.016 kg/Mg produced	Incinerator	13
	Methyl chloroform production -			
	Hydrochlorinator vent condenser	8.5 kg/Mg produced		13
	Steam stripper vent condenser	0.5 kg/Mg produced		13
	Ethylene amine production	9.09 kg/Mg produced		13
	Trichloroethylene production	5.0 kg/Mg produced		13
	Perchloroethylene production -			
	Chlorination and oxychlorination	5.0 kg/Mg produced	Controlled	13
	Waste handling	0.026 kg/Mg produced	Uncontrolled	13
	Secondary emissions	0.00026 kg/Mg produced		13
	Vinylidene chloride production	5.7 kg/Mg produced	Controlled	13
	Ethyl chloride production	9.45 kg/Mg produced		13
	Polysulfide rubber production	33.8 kg/Mg produced	Controlled	13
	Use in leaded gasoline	0.14 mg/l produced		13
	Blending of gasoline	1 kg/Mg blended		13
	Gasoline tank car/truck loading -			
	Normal service	0.269 mg/l transferred		13
	Balance service	0.192 mg/l transferred		13
	Underground gasoline tank filling (splash filling)	0.26 mg/l transferred		13

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Ethylene dichloride (continued)	Vehicle refueling -			
	Displacement losses	0.21 mg/l transferred	Uncontrolled	13
		0.021 mg/l transferred	Controlled	13
Formaldehyde	Formaldehyde production -			
	Silver catalyst process			
	Absorber	0.38 kg/Mg of 37% solution produced	Uncontrolled	12
		0.0076 kg/Mg of 37% solution produced	Thermal oxidation	12
		0.076 kg/Mg of 37% solution produced	Flare	12
	Product fractionator	0.33 kg/Mg of 37% solution produced	Uncontrolled	12
		0	Recycle to absorber	12
		0.017 kg/Mg of 37% solution produced	Water scrubber	12
	Start up vent	0.10 kg/Mg of 37% solution produced	Uncontrolled	12
	Formaldehyde storage	0.03 kg/Mg of 37% solution produced	Uncontrolled	12
		0.003 kg/Mg of 37% solution produced	Vent scrubber	12
		0.0006 kg/Mg of 37% solution produced	Thermal oxidation	12
	Handling	0.01 kg/Mg of 37% solution produced	Uncontrolled	12
		0.0004 kg/Mg of 37% solution produced	Vapor recovery	12
	Process fugitives	0.70 kg/Mg of 37% solution produced	Uncontrolled	12
		0.063 - 0.30 kg/Mg of 37% solution produced	Inspection/maintenance	12
	Formaldehyde production - metal oxide catalyst process			
	Absorber	0.47 kg/Mg of 37% solution produced	Uncontrolled	12
		0.009 kg/Mg of 37% solution produced	Thermal oxidation	12
	Formaldehyde storage	0.03 kg/Mg of 37% solution produced	Uncontrolled	12
		0.003 kg/Mg of 37% solution produced	Vent scrubber	12
	Handling	0.01 kg/Mg of 37% solution produced	Uncontrolled	12
		0.0004 kg/Mg of 37% solution produced	Vapor recovery	12
	Process fugitive	0.47 kg/Mg of 37% solution produced	Uncontrolled	12
		0.099 - 0.13 kg/Mg of 37% solution produced	Inspection/maintenance	12

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Formaldehyde (continued)	Urea - formaldehyde, melamine formaldehyde resin production			
	Process	0.15-1.5 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.03-0.2 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.03-0.2 kg/Mg of 37% formaldehyde used		12
	Phenol-formaldehyde resin production -			
	Process	0.15-1.5 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.03-0.2 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.03-0.2 kg/Mg of 37% formaldehyde used		12
	Polyacetal resin production -			
	Process	0.09-0.37 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.02-0.03 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.02-0.36 kg/Mg of 37% formaldehyde used		12
	Hexamethylenetetramine production -			
	Process	<0.39 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.05 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.11 kg/Mg of 37% formaldehyde used		12
	Pentaerythritol production -			
	Process	1.3-2.7 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.002-0.33 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.14-0.15 kg/Mg of 37% formaldehyde used		12
	1,4-Butanediol production -			
	Process	<0.74 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.005-0.2 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.005-0.2 kg/Mg of 37% formaldehyde used		12

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Formaldehyde (continued)	Trimethylolpropane production -			
	Process	0.074 kg/Mg of 37% formaldehyde used		12
	Formaldehyde storage	0.01 kg/Mg of 37% formaldehyde used		12
	Fugitive	0.01 kg/Mg of 37% formaldehyde used		12
	Phthalic anhydride production -	2.1 kg/Mg produced	Uncontrolled	12
		0.074 kg/Mg produced	Direct incineration	12
	Solid urea production -			
	Fluidized bed prilling (agricultural grade)	0.095 kg/Mg produced	Uncontrolled	12
		0.0004 kg/Mg produced	Controlled	12
	Drum granulation	0.0055 kg/Mg produced	Uncontrolled	12
		0.0027 kg/Mg produced	Controlled	12
	Stationary internal combustion engines -			
	Gas turbines	4.0 ng/J heat input		12
	Gas fired reciprocating engines	5.7 ng/J heat input		12
	Process heaters	1.9 ng/J heat input		12
	Automobiles -			
	Catalyst	0.05 - 0.83 g/gallon		12
	Non-catalyst	0.83 g/gallon		12
	Diesel	0.33 g/gallon		12
	Petroleum refining -			
	Catalytic cracking	1.0 - 2.2 kg/1000 bbl feed		12
	Coking	0.54 kg/1000 bbl feed		12
	Integrated circuit board manufacture	0.50 ton/100,000 ft^2 product		4
	Hot mix asphalt plants	0.00015 lb/ton asphalt		3
	Wood combustion -			
	Commercial/industrial	0.48 lb/ton		3
	Residential woodstoves	0.46 - 0.48 lb/ton		2, 3
	Residential fireplaces	3.0 lb/ton		3

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Formaldehyde (continued)	Bituminous coal combustion -			
	Residential	0.0024 lb/ton burned		2
	Utility boiler - pulverized dry bottom	59.3 pg/J heat input	Multicyclone or scrubber	7
	Utility boiler - pulverized wet bottom	35.3 pg/J heat input	Multicyclone or scrubber	7
	Utility boiler - cyclone	56.8 pg/J heat input	Multicyclone	7
	Utility boiler - stoker	37.4 pg/J heat input	Multicyclone	7
	Utility boiler - stoker	60.2 pg/J heat input	Uncontrolled	7
	Coal combustion	0.03 lb/ton 0.002 lb/ton	Uncontrolled ESP	2 2
	Oil combustion, commercial/industrial	0.033 lb/1000 gal	Uncontrolled	2
Gasoline vapors	Vehicle fueling	5.0 g/gallon	Uncontrolled	1
	Underground tank filling	3.0 g/gallon	Uncontrolled	1
	Underground tank breathing losses	0.5 g/gallon	Uncontrolled	1
Gaseous fluorides	Aluminum: anode baking furnace	0.9 lb/ton produced 0.009 - 0.004 lb/ton produced	Uncontrolled Controlled	4 4
	Aluminum: prebake cell	24 lb/ton produced 0.2 - 3.4 lb/ton produced	Uncontrolled Controlled	4 4
	Aluminum: Sodorberg stud cell	33 lb/ton produced 0.3 - 4.9 lb/ton produced	Uncontrolled Controlled	4 4
Lead	Utility boilers - pulverized dry bottom	39.1 pg/J heat input 10.4 pg/J heat input 53 pg/J heat input	ESP, bituminous coal Scrubber, bituminous coal Uncontrolled, bituminous coal	7 7 7
	Utility boilers - pulverized wet bottom	53 pg/J heat input	ESP, bituminous coal	7
	Utility boilers - cyclone	5.0 pg/J heat input	ESP, bituminous coal	7
	Utility boilers - stoker	610 pg/J heat input	Multicyclone, bituminous coal	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Lead (continued)	Utility boilers - pulverized	39.8 pg/J heat input	ESP, anthracite coal	7
	Utility boilers - stoker	610 pg/J heat input	Multicyclone, anthracite coal	7
	Utility boilers - pulverized dry bottom	2.5 pg/J heat input	ESP, lignite coal	7
	Utility boilers - pulverized wet bottom	4.6 pg/J heat input	ESP, lignite coal	7
	Utility boilers - cyclone	112 pg/J heat input	ESP, lignite coal	7
		154 pg/J heat input	Scrubber, lignite coal	7
	Utility boilers - stoker	121 pg/J heat input	Multicyclone, lignite coal	7
	Utility boilers - tangential, wall	4.0 pg/J heat input	Residential, ESP	7
		20.0 pg/J heat input	Residential, ESP	7
	Industrial boiler -			
	Coal - pulverized	161 pg/J heat input	ESP	7
		8.8 pg/J heat input	Multicyclone	7
		121 pg/J heat input	Scrubber	7
		121 pg/J heat input	Uncontrolled	7
	Coal - stoker	282 pg/J heat input	Multicyclone, also commercial boilers	7
		4.1 pg/J heat input	Uncontrolled	7
	Oil - tangential and wall	20.4 pg/J heat input	Scrubber, also commercial boilers	7
		4.1 pg/J heat input	Uncontrolled, also commercial boilers	7
	Residential boilers -			
	All	359 pg/J heat input	Bituminous coal	7
	All	265 pg/J heat input	Anthracite coal	7
	All	17.2 pg/J heat input	Lignite coal	7
	All	9.5 pg/J heat input	Distillate oil	7
	Gray iron foundries -			
	Cupola	0.1 - 1.1 lb/ton produced	Uncontrolled	26
	Reverberatory furnace	0.012 - 0.14 lb/ton produced	Uncontrolled	26
	Electric induction	0.009 - 0.1 lb/ton produced	Uncontrolled	26
Manganese	Submerged-arc electric furnaces producing ferromanganese and silicomanganese -			
	Ferromanganese, open furnace	13.2 lb/ton product	Uncontrolled	25

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Manganese (continued)	Ferromanganese, semisealed	5.2 lb/ton product	Uncontrolled	25
	Ferromanganese, sealed	19.2 lb/ton product	Uncontrolled	25
	Silicomanganese	46.4 lb/ton product	Uncontrolled	25
	Ferromanganese, open furnace	0.4 lb/ton product	Scrubber	25
	Ferromanganese, semisealed	0.08 lb/ton product	Scrubber	25
	Ferromanganese, sealed	0.008 lb/MWhr	Scrubber	25
	Silicomanganese, open furnace	0.11 lb/MWhr	Scrubber	25
	Silicomanganese, semisealed	0.032 lb/ton product	Scrubber	25
	Silicomanganese, sealed	0.002 lb/MWhr	Scrubber	25
	Synthetic manganese production -			
	Drying and grinding	8.9 lb/ton material processed	Uncontrolled	25
		0.009 lb/ton processed	Fabric filter	25
	Roasting	110 lb/ton processed	Uncontrolled	25
		0.22 lb/ton processed	Fabric filter	25
	Packaging/handling	5.4 lb/ton processed	Uncontrolled	25
		0.0054 lb/ton processed	Fabric filter	25
	Iron blast furnaces -			
	Slips	0.261 lb/slip		25
	Casthouse	0.0018 lb/ton iron		25
	Sintering	0.134 lb/ton sinter	Uncontrolled	25
		0.002 lb/ton sinter	Dry ESP	25
		0.0192 lb/ton sinter	Wet ESP	25
		0.0056 lb/ton sinter	Scrubber	25
		0.012 lb/ton sinter	Cyclone	25
	Sinter discharge	0.08 lb/ton sinter	Uncontrolled	25
		0.0012 lb/ton sinter	Fabric filter	25
	Windbox and discharge	0.0036 lb/ton sinter	Fabric filter	25
	Open hearth furnaces -			
	Melting/refining	0.078 lb/ton pig iron	Uncontrolled	25
		0.001 lb/ton	ESP	25
	Teeming	0.00026 lb/ton	Uncontrolled	25

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Manganese (continued)	Basic oxygen furnace -			
	Melting/refining	0.288 lb/ton steel	Uncontrolled	25
		0.013 lb/ton steel	ESP	25
		0.009 lb/ton steel	Scrubber	25
	Charging	0.006 lb/ton steel	Uncontrolled, at source	25
	Tapping	0.0092 lb/ton steel	Uncontrolled, at source	25
	Hot metal transfer	0.0004 lb/ton	Uncontrolled, at source	25
	Chemical manufacture -			
	Ore drying/grinding	8.9 lb/ton material processed	Uncontrolled	25
		0.009 lb/ton material processed	Fabric filter	25
	Ore roasting	110 lb/ton	Uncontrolled	25
		0.22 lb/ton	Fabric filter	25
	Electric arc furnaces -			
	Melt/refine carbon steel	1.33 lb/ton product	Uncontrolled	25
	Charging, tapping, slagging	0.049 lb/ton	Uncontrolled, at roof monitor	25
	Iron foundries -			
	Cupola	0.25 lb/ton iron	Uncontrolled	25
		0.003 lb/ton iron	Fabric filter	25
		0.075 lb/ton iron	Impingement scrubber	25
	Electric arc furnace	0.95 lb/ton iron	Uncontrolled	25
		0.0015 lb/ton iron	Fabric filter	25
	Induction furnace	0.0225 lb/ton iron	Uncontrolled	25
	Steel foundries -			
	Electric arc furnace	0.52 lb/ton steel	Uncontrolled	25
		0.026 lb/ton	ESP	25
		0.013 lb/ton	Venturi scrubber	25
		0.0008 lb/ton	Fabric filter	25
	Induction furnace	0.004 lb/ton	Uncontrolled	25

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Manganese (continued)	Battery manufacture -			
	Ore grinding	30 lb/ton material processed	Uncontrolled	25
		0.03 lb/ton material processed	Fabric filter	25
	Screening	1.0 lb/ton material processed	Uncontrolled	25
		0.001 lb/ton material processed	Fabric filter	25
	Storage/handling	4.4 lb/ton material processed	Uncontrolled	25
		0.0044 lb/ton material processed	Fabric filter	25
	Industrial boilers -			
	Pulverized	29.4 pg/J heat input	Multicyclone, bituminous coal	25
	Stoker	47.3 pg/J heat input	Scrubber, bituminous coal	25
	Tangential, wall	1.3 pg/J heat input	Scrubber, residual oil	25
		6.5 pg/J heat input	Uncontrolled, residual oil	25
	Commercial/institutional boilers -			
	Stoker	111 pg/J heat input	Uncontrolled, bituminous coal	25
	All	6.5 pg/J heat input	Residual oil	25
	All	0.6 pg/J heat input	Distillate oil	25
	Residential boilers -			
	All	2150 pg/J heat input	Uncontrolled, bituminous coal	25
	All	66.2 pg/J heat input	Uncontrolled, anthracite coal	25
	All	430 pg/J heat input	Uncontrolled, lignite coal	25
	All	0.6 pg/J heat input	Uncontrolled, distillate oil	25
	Wood combustion, residential	1.0 lb/ton burned		3
	Cement plants -			
	Dry process, kiln	122 lb/10^3 ton cement produced	Uncontrolled	25
		0.021 - 0.125 ton cement produced	ESP	25
		0.013 - 0.124 ton cement produced	Fabric filter	25
	Dryer/grinder	48 lb/10^3 ton cement produced	Uncontrolled	25
	Wet process, kiln	114 lb/10^3 ton cement produced	Uncontrolled	25
		0.02-0.142 lb/10^3 ton cement produced	ESP	25
		0.049-0.132 lb/10^3 ton cement produced	Fabric filter	25

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Manganese (continued)	Dryer/grinder	16 lb/10^3 tons cement produced	Uncontrolled	25
	Clinker cooler	0.005-0.061 lb/10^3 ton cement produced	Fabric filter	25
		0.023-0.045 lb/10^3 ton cement produced	Gravel bed	25
		0.022 lb/10^3 ton cement produced	Wet scrubber	25
	Municipal refuse incinerators	0.05 lb/ton waste incinerated	Uncontrolled	25
		0.01 lb/ton waste incinerated	ESP	25
	Sewage sludge incinerator, multiple hearth	0.004 lb/ton waste incinerated	Wet scrubber	25
	Sewage sludge incinerator, fluidized bed	0.0006 lb/ton waste incinerated	Wet scrubber	25
	Waste oil combustion	0.0075 - 0.14 lb/1000 gal		3
Mercury	Mining	0.01 lb/ton ore mined		8
	Primary ore processing -			
	Smelter	0.031 lb/ton ore processed	Uncontrolled	8
	Hoeing	0.02 lb/ton ore processed	Uncontrolled	8
	Retort	0.002 lb/ton ore processed	Uncontrolled	8
	Secondary production	40 lb/ton mercury processed	Uncontrolled	8
	Electrolytic chlorine production, hydrogen stream	0.002-0.01 lb/ton of chlorine produced	Uncontrolled	8
	Coal combustion	0.098 - 0.82 lb/10^3 tons		8
	Oil combustion	0.000008 - 0.002 lb/10^3 gal		8
	Municipal waste incinerators	0.002 lb/ton		2
	Sewage sludge incinerators	14 - 18 lb/1000 tons		2
	Waste oil combustion	1.68 - 3.04 lb/1000 gal		3
Methylene chloride	Vapor degreasing	0.56 kg/kg MC consumed	Use of MC divided equally between open top and conveyorized degreasing processes.	21
	Photoresist stripping	0.57 kg/kg of fresh solvent		21

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Methylene chloride (continued)	Integrated circuit board manufacturer -			
	Stripper	1.92 ton/100,000 ft^2 of product		4
Nickel	Primary smelting of nickel ore -		Factors expressed as total nickel.	
	Rotary dryers	0.042-0.56 lb/ton of nickel produced	Cyclone/scrubber	10
	Crusher house	0.012-0.092 lb/ton of nickel produced	Fabric filter	10
	Day bin	0.00065-0.0019 lb/ton of nickel produced	Fabric filter	10
	Calciners	0.46 lb/ton of nickel produced	ESP	10
	Skip hoists	0.027-0.067 lb/ton of nickel produced	Fabric filter	10
	Ore melter/roaster combination	0.054-0.092 lb/ton of nickel produced	Fabric filter	10
	Refining furnace	0.013 lb/ton of nickel produced	Fabric filter	10
	Open hearth furnace -			
	Melt furnace	0.0011 lb/ton of steel produced	ESP	10
		0.0085 lb/ton of steel produced	Uncontrolled	10
	Battery manufacturing	8.8 lb/ton of nickel processed		10
	Nonferrous metals production sources -			
	Nickel-copper, copper-nickel	2 lb/ton of nickel charged	Fabric filter	10
	Super alloys	2 lb/ton of nickel charged	Fabric filter	10
	Permanent magnet alloys	2 lb/ton of nickel charged	Fabric filter	10
	Electrical alloys	2 lb/ton of nickel charged	Fabric filter	10
	Other nonferrous alloys	2 lb/ton of nickel charged	Fabric filter	10
	Oil combustion -			
	Domestic crude	20-500 lb/10^6 gal oil		10
	Foreign crude	200 lb/10^6 gal oil		10
	Residual #6	83 lb/10^6 gal oil		10
	Residual #5	64 lb/10^6 gal oil		10

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	Residual #4	48 lb/10^6 gal oil		10
	Residual	63-1056 pg/J (nickel emitted per unit of heat energy in fuel)		10
	Residual	57-63 pg/J (nickel emitted per unit of heat energy in fuel)	Controlled; ESP or scrubber	10
	Distillate #2	0.38-0.41 lb/10^6 gal oil		10
	Distillate #2	290 pg/J (nickel emitted per unit of heat energy in fuel)		10
	Distillate #2	13-446 pg/J (nickel emitted per unit of heat energy in fuel)		10
	Coal combustion -		Factors expressed as total nickel emitted per unit per energy in fuel.	
	Stoker, anthracite coal	135 - 470 pg/J heat input	Uncontrolled; measured	10
		29 pg/J heat input	MC; calculated	10
	Pulverized, anthracite coal	30 pg/J heat input	ESP; calculated	10
	Pulverized, bituminous coal	130 - 2900 pg/J heat input	Uncontrolled; calculated	10
		1045 pg/J heat input	Uncontrolled; measured	10
		709 - 870 pg/J heat input	MC; calculated	10
		16 pg/J heat input	MC; measured	10
		50 - 62 pg/J heat input	ESP; calculated	10
		4.3 - 2480 pg/J heat input	ESP; measured	10
		213 - 227 pg/J heat input	WS; calculated	10
		0.48 - 133 pg/J heat input	WS; measured	10
	Cyclone, bituminous coal	147 pg/J heat input	MC; calculated	10
		2 - 11 pg/J heat input	ESP; calculated	10
		429 - 1330 pg/J heat input	ESP; measured	10
		470 pg/J heat input	Uncontrolled; measured	10
		38 pg/J heat input	WS; calculated	10
		20 pg/J heat input	WS; measured	10
	Stoker, bituminous coal	400 - 2200 pg/J heat input	Uncontrolled; calculated	10
		13 - 1463 pg/J heat input	Uncontrolled; measured	10
		670 pg/J heat input	MC; calculated	10
		13 - 2230 pg/J heat input	MC; measured	10
		71 pg/J heat input	FF; measured	10

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	Pulverized, lignite coal	228 pg/J heat input	MC; calculated	10
		115 - 263 pg/J heat input	MC; measured	10
		8.3 - 13 pg/J heat input	ESP; calculated	10
		<68 pg/J heat input	ESP; measured	10
		161 pg/J heat input	WS; calculated	10
	Cyclone, lignite coal	4.5 pg/J heat input	ESP; calculated	10
		<47 pg/J heat input	ESP; measured	10
		87 pg/J heat input	WS; calculated	10
		221 - 320 pg/J heat input	MC; calculated	10
	Stoker, lignite coal	276 pg/J heat input	MC; measured	10
		<38 pg/J heat input	ESP; measured	10
	Wood combustion	2 - 65 pg/J heat input		10
	Fresh water utlity cooling tower -		Factors expressed as weight of pollutant per thermal energy input to power plant associated with the cooling tower.	
	Drift loss range of 0.1 to 0.2%	16 pg/J heat input		10
	Drift loss range of 0.002 to 0.005%	0.34 pg/J heat input		10
	Major cement plant sources -		Factors expressed as total nickel and in terms of amount of raw material feed input.	
	Dry cement process			
	Kiln	0.3 lb/1000 tons	Fabric filter	10
	Feed to initial grinding mill	0.01 lb/1000 tons	Fabric filter	10
	Air separator after initial grinding mill	0.001 lb/1000 tons	Fabric filter	10
	Raw material grinding mills	0.0006 lb/1000 tons	Fabric filter	10
	Feed to finish grinding mill	0.01 lb/1000 tons	Fabric filter	10
	Air separator after finish grinding mill	0.006 lb/1000 tons	Fabric filter	10
	Wet cement process			
	Kiln	0.2 to 2 lb/1000 tons	ESP	10

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	Clinker cooler	0.004 lb/1000 tons	Fabric filter	10
		0.1 lb/1000 tons	ESP	10
		0.2 lb/1000 tons	Two fabric filters in parallel	10
	Finishing grinding mill after air separator	0.004 lb/1000 tons	Fabric filter	10
	Municipal refuse incinerators -		Factors expressed as total elemental nickel.	
	Refuse only	0.003 lb/ton of solid waste incinerated	Wet scrubber	10
	Refuse and sludge	0.005 lb/ton of solid waste incinerated	Wet scrubber	10
	Sewage sludge incinerators -			
	Multiple hearth	0.003 lb/ton of solid waste incinerated	Wet scrubber	10
	Fluidized bed	0.0003 lb/ton of solid waste incinerated	Wet scrubber	10
	Uncontrolled multiple-hearth or fluidized-bed unit	0.15 lb/ton of solid waste incinerated	Wet scrubber	10
	Secondary processing of nickel-bearing scrap -		Factors apply to individual melting furnaces	
	Stainless steel	10 lb/ton of nickel charged	Controlled	10
		0.6 lb/ton of steel produced	Controlled	10
	Nickel alloy steels	10 lb/ton of nickel charged	Controlled	10
	Iron and steel scrap	0.0015 lb/ton of iron and steel produced	Controlled	10
	Other nickel alloys	2 lb/ton of nickel charged	Controlled	10
	Copper base alloys	2 lb/ton of nickel charged	Controlled	10
	Electrical alloys	2 lb/ton of nickel charged	Controlled	10
	Cast iron	20 lb/ton of nickel charged	Uncontrolled	10

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	Steel manufacturing operations -		Factors expressed as total nickel.	
	Open hearth furnace	0.00018 lb/ton of steel produced	ESP	10
	Open hearth fugitive emissions	0.00005 lb/ton of steel produced	Uncontrolled	10
	Basic oxygen process furnace	0.000018 lb/ton of steel produced	Scrubber	10
	Basic oxygen process fugitives	0.0001 lb/ton of steel produced	Uncontrolled	10
	Electric arc furnace (carbon steel)	0.0083 lb/ton of steel produced 0.000013 - 0.000084 lb/ton of steel produced	Uncontrolled Fabric filter	10 10
	Electric arc furnace (alloy steel)	0.025 lb/ton of steel produced 0.000039 - 0.00025 lb/ton of steel produced	Uncontrolled Fabric filter	10 10
	Electric arc furnace fugitive emissions (carbon steel)	0.00054 lb/ton of steel produced 0.00011 lb/ton of steel produced	Uncontrolled Hoods and fabric filter	10 10
	Electric arc furnace fugitive (alloy steel)	0.0016 lb/ton of steel produced 0.00032 lb/ton of steel produced	Uncontrolled Hoods and fabric filter	10 10
	Electric arc furnace (stainless steel)	0.3 lb/ton of steel produced 0.003 lb/ton of steel produced	Uncontrolled Fabric filter	10 10
	Electric arc furnace fugitive emissions (stainless steel)	0.036 lb/ton of steel produced 0.0072 lb/ton of steel produced	Uncontrolled Hoods and fabric filter	10 10
	Argon oxygen decarburization vessel (stainless steel)	0.32 lb/ton of steel produced 0.064 lb/ton of steel produced	Uncontrolled Fabric filter	10 10
	Coke ovens	0.0016 lb/ton of coal produced	Uncontrolled	10
	Asbestos mining	0.000018 lb/ton	Controlled	10
	Oil combustion -			
	U.S. crude oils	0.01 - 0.5 lb/1000 gal	1.4 - 64 ppm nickel content	8
	Imported crude oils, average	0.07 lb/1000 gal	0.3 - 28.9 ppm nickel content	8
	Foreign crude oils	0.01 - 0.4 lb/1000 gal	1.8 - 59 ppm nickel content	8
	Foreign residual oils	0.03 - 0.5 lb/1000 gal	4 - 61.2 ppm nickel content	8
	U.S boilers			
	Distillate oil - residential units	0.0004 - 0.0005 lb/1000 gal		8

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	#6 Residual oil + commercial units	0.08 lb/1000 gal	48.5 ppm nickel content	8
	#5 Residual oil - commercial units	0.06 lb/1000 gal	31 ppm nickel content	8
	#4 Residual oil - commercial units	0.05 lb/1000 gal	18 ppm nickel content	8
	Waste incineration -			
	Lubricating oil	0.07 lb/1000 gal of lubricating oil	Emission factor for nickel oxides	8
	Coal combustion - utility boilers -			
	Pulverized dry bottom, bituminous coal	30.1 pg/J	ESP	7
		22.1 pg/J	Scrubber	7
		130 pg/J	Uncontrolled	7
	Pulverized wet bottom, bituminous coal	24.3 pg/J	ESP	7
	Cyclone, bituminous coal	20 pg/J	ESP	7
		130 pg/J	Uncontrolled	7
	Stoker, bituminous coal	29.2 pg/J	Multicyclones	7
	Pulverized, anthracite coal	30.1 pg/J	ESP	7
	Stoker, anthracite coal	29.2 pg/J	Multicyclones	7
	Pulverized dry bottom, lignite coal	13.2 pg/J	ESP	7
	Pulverized wet bottom, lignite coal	2.0 pg/J	ESP	7
	Cyclone, lignite coal	4.5 pg/J	ESP	7
		320 pg/J	Multicyclones	7
	Stoker, lignite coal	29.2 pg/J	Multicyclones	7
	Oil combustion - utility boilers -			
	Tangential, residual oil	57.2 pg/J	ESP	7
		287 pg/J	Uncontrolled	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Nickel (continued)	Wall, residual oil	57.2 pg/J	ESP	7
		287 pg/J	Uncontrolled	7
	Coal combustion - industrial boilers -			
	Pulverized, coal	39.0 pg/J heat input	Multicyclones	7
		26.0 pg/J heat input	Scrubber	7
	Stoker, coal	29.2 pg/J heat input	Multicyclones	7
		68.4 pg/J heat input	Uncontrolled	7
	Oil combustion - industrial boilers -			
	Tangential, oil	62.8 pg/J heat input	Scrubber	7
		31.4 pg/J heat input	Uncontrolled	7
	Wall, oil	62.8 pg/J heat input	Scrubber	7
		31.4 pg/J heat input	Uncontrolled	7
	Coal combustion - commercial boilers -			
	Stoker, coal	68.4 pg/J heat input	Uncontrolled	7
	Oil combustion - commercial boilers -			
	Tangential, residual oil	804 pg/J heat input	Uncontrolled	7
	Tangential, distillate oil	112 pg/J heat input	Uncontrolled	7
	Wall, residual oil	804 pg/J heat input	Uncontrolled	7
	Wall, distillate oil	112 pg/J heat input	Uncontrolled	7
	Coal combustion - residential boilers -			
	All furnaces, bituminous coal	71.8 pg/J heat input	Uncontrolled	7
	All furnaces, anthracite coal	66.2 pg/J heat input	Uncontrolled	7
	All furnaces, lignite coal	17.2 pg/J heat input	Uncontrolled	7
	Oil combustion - residential boilers -			
	All furnaces, distillate oil	103 pg/J heat input	Uncontrolled	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Perchloroethylene (PCE)	Clothes cleaning -			
	Coin-operated	15.7 kg PCE/100 kg clothes cleaned		18
	Commercial	9.5 kg PCE/100 kg clothes cleaned		18
	Industrial	10.4 kg PCE/100 kg clothes cleaned		18
	PCE production	0.002 lb/lb PCE produced		6
	Storage and handling	2.3 lb/1000 gal		7
	Degreasing -			
	Open top vapor degreasing	0.78 kg/kg PCE consumed		18
	Conveyorized degreasing	0.85 kg/kg PCE consumed		18
	Weighted average (use of PCE divided equally between open top and conveyorized degreasing)	0.72 kg/kg PCE consumed		18
	Accounting for recycled solvent	0.92 kg/kg fresh PCE used in degreasing		18
Phenol	Caprolactum production	0.00144 lb/lb phenol used		3
	Phenol - formaldehyde resin production -			
	Process	0.00035 lb/lb used		3
	Storage	0.00002 lb/lb used		3
	Fugitive	0.00013 lb/lb used		3
	Phenol production -			
	Process	0.00178 lb/lb produced		3
	Storage	0.00003 lb/lb produced		3
	Fugitive	0.00041 lb/lb produced		3
	Wood combustion - residential -			
	Woodstove	2.0 lb/ton		3
	Fireplace	2.0 lb/ton		3
	Wood combustion - commercial and industrial	2.0 lb/ton		3
Phosgene	Phosgene plant	2.35 - 34.8 lb/10^6 lb processed		23

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Phosgene (continued)	Diisocyanate plant using phosgene produced on site -			
	Phosgene production	2.35 - 34.8 lb/10^6 lb phosgene produced		23
	Toluene diisocyanate production	1.18 - 14.1 lb/10^6 lb phosgene produced		23
	Polycarbonate plant using phosgene produced on site -			
	Phosgene production	2.35 - 34.8 lb/10^6 lb phosgene produced		23
	Polycarbonate production	0.55 - 6.2 lb/10^6 lb phosgene produced		23
	Herbicide and pesticide plant using phosgene produced on site -			
	Phosgene production	2.35 - 34.8 lb/10^6 lb phosgene produced		23
	Herbicide and pesticide production	0.55 - 6.4 lb/10^6 lb phosgene produced		23
Polychlorinated biphenyls	Waste oil combustion	0.0075 lb/gal	Waste oil burned	3
Polycyclic organic matter	Coal combustion	0.000076 lb/ton burned	Uncontrolled	2
		0.000007 lb/ton burned	Multicyclone	2
		0.00004 lb/ton burned	ESP	2
		0.14 lb/ton burned	Residential; bituminous coal	2
	Oil combustion - commercial and industrial	0.000175 lb/1000 gal	Uncontrolled	2
	Charcoal manufacturing	0.007 lb/ton		2
	Coke production	0.01 lb/ton coke		2
	Incineration of scrap wood -			
	Industrial boilers	0.002 g/kg		2
	Residential boilers	0.27 g/kg		2
	Municipal waste incinerators	<0.001 lb/ton		2
	Wood combustion - residential -			
	Woodstoves	0.54 lb/ton		2
		0.55 lb/ton		3

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Polycyclic organic matter (continued)	Fireplaces	0.058 lb/ton		2
	Hot-mix asphalt plants	0.000026 lb/ton		3
	Wood combustion - commercial, industrial	0.004 lb/ton		3
	Coal combustion - utility boilers -			
	Pulverized dry bottom, bituminous coal	1.0 pg/J heat input 1.2 pg/J heat input	ESP Multicyclones	7 7
	Pulverized wet bottom, bituminous coal	1.0 pg/J heat input 1.0 pg/J heat input	ESP Multicyclones	7 7
	Cyclone, bituminous coal	1.0 pg/J heat input	ESP	7
	Stoker, bituminous coal	1.2 pg/J heat input	Multicyclones	7
	Stoker, anthracite coal	1.2 pg/J heat input	Multicyclones	7
	Pulverized dry bottom, lignite coal	1.1 pg/J heat input	ESP	7
	Pulverized wet bottom, lignite coal	0.09 pg/J heat input	ESP	7
	Cyclone, lignite coal	1.1 pg/J heat input 1.1 pg/J heat input	ESP Multicyclones	7 7
	Stoker, lignite coal	1.1 pg/J heat input	Multicyclones	7
	Oil combustion - utility boilers -			
	Tangential, residential oil	0.04 pg/J heat input 0.09 pg/J heat input	ESP Uncontrolled	7 7
	Wall, residual oil	0.04 pg/J heat input 0.09 pg/J heat input	ESP Uncontrolled	7 7
	Coal combustion - industrial boilers -			
	Pulverized, coal	9.5 pg/J heat input	Multicyclones	7
	Stoker, coal	13.2 pg/J heat input 31.0 pg/J heat input	Multicyclones Uncontrolled	7 7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Polycyclic organic matter (continued)	Oil combustion - industrial boilers -			
	Tangential, oil	0.5 pg/J heat input	Uncontrolled	7
	Wall, oil	0.8 pg/J heat input	Uncontrolled	7
	Coal combustion - commercial boilers -			
	Pulverized, coal	19.1 pg/J heat input	Uncontrolled	7
	Stoker, coal	45.2 pg/J heat input	Uncontrolled	7
	Oil combustion - commercial boilers -			
	Tangential, residual oil	44.0 pg/J heat input	Uncontrolled	7
	Wall, residual oil	44.0 pg/J heat input	Uncontrolled	7
	Tangential, distillate oil	20.0 pg/J heat input	Uncontrolled	7
	Wall, distillate oil	30.0 pg/J heat input	Uncontrolled	7
	Coal combustion - residential boilers -			
	All furnaces, bituminous coal	1737 pg/J heat input	Uncontrolled	7
	All furnaces, anthracite coal	1032 pg/J heat input	Uncontrolled	7
	All furnaces, lignite coal	3600 pg/J heat input	Uncontrolled	7
	Oil combustion - residential boilers -			
	All furnaces, distillate oil	10.3 pg/J heat input	Uncontrolled	7
Selenium	Utility boilers -			
	Pulverized dry bottom	13.0 pg/J heat input	Scrubber, bituminous coal	7
	Pulverized wet bottom	16.3 pg/J heat input	ESP, bituminous coal	7
		161 pg/J heat input	MC, bituminous coal	7
		10.5 pg/J heat input	Scrubber, bituminous coal	7
	Cyclone	1.4 pg/J heat input	Scrubber, bituminous coal	7
	Stoker	33.0 pg/J heat input	MC, bituminous coal	7
	Pulverized	36.1 pg/J heat input	ESP, anthracite coal	7
	Stoker	0.01 pg/J heat input	MC, anthracite coal	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Selenium (continued)	Pulverized dry bottom	36.1 pg/J heat input	MC, lignite coal	7
		5.7 pg/J heat input	Scrubber, lignite coal	7
		18.1 pg/J heat input	Uncontrolled, lignite coal	7
	Pulverized wet bottom	14.2 pg/J heat input	MC, lignite coal	7
	Cyclone	3.4 pg/J heat input	Scrubber, lignite coal	7
		3.1 pg/J heat input	MC, lignite coal	7
	Stoker	36.1 pg/J heat input	Uncontrolled, lignite coal	7
	Tangential, wall	2.0 pg/J heat input	Scrubber, residual oil	7
		10.1 pg/J heat input	Uncontrolled, residual oil	7
	Industrial boilers -			
	Pulverized	48.6 pg/J heat input	MC, coal-fired	7
		41.0 pg/J heat input	Scrubber, coal-fired	7
	Stoker	36.1 pg/J heat input	MC, coal-fired	7
		84.3 pg/J heat input	Uncontrolled, coal-fired	7
	Tangential, wall	2.0 pg/J heat input	Scrubber, oil-fired	7
		10.1 pg/J heat input	Uncontrolled, oil-fired	7
	Commercial boilers -			
	Stoker	84.3 pg/J	Uncontrolled, coal-fired	7
	Tangential, wall	10.1 pg/J	Uncontrolled, residual or distillate oil	7
	Residential boilers -			
	All	143 pg/J	Uncontrolled, bituminous coal	7
	All	99.3 pg/J	Uncontrolled, anthracite coal	7
	All	51.6 pg/J	Uncontrolled, lignite coal	7
	All	2.9 pg/J	Uncontrolled, distillate oil	7
Toluene	Waste oil combustion	0.37 - 35.9 lb/1000 gal		3
	Benzoic acid production -			
	Process	0.0010 lb/lb produced		3
	Storage	0.0004 lb/lb produced		3
	Fugitive	0.0002 lb/lb produced		3

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Toluene (continued)	Benzaldehyde production -			
	Process	0.0009 lb/lb produced		3
	Storage	0.0004 lb/lb produced		3
	Fugitive	0.0002 lb/lb produced		3
	Coke production	0.48 lb/ton coke		2
Trichloroethylene	Open top vapor degreasing	0.785 kg/kg used		20
	Conveyorized degreasing	0.85 kg/kg used		20
Vanadium (V)	Industrial sources -			
	Mining and processing	25 lb/ton of V processed	Uncontrolled	8
	Metallurigical processing			
	Ferrovanadium, electric furnaces	50 lb/ton of V processed	Uncontrolled	8
	Handling losses	10 lb/ton of V processed	Uncontrolled	8
	Steel production			
	Blast furnace	0.03 lb/ton of pig iron produced	Uncontrolled	8
	Open-hearth furnace			
	No oxygen lance	0.006 lb/ton of steel produced	Uncontrolled	8
	Oxygen lance	0.01 lb/ton of steel produced	Uncontrolled	8
	Basic oxygen furnace	0.002 lb/ton of steel produced	Two venturi scrubbers	8
		0.009 lb/ton of steel produced	Uncontrolled	8
	Electric furnace	Negligible	Uncontrolled	8
	Cast iron production	0.2 lb/1000 ton of charge	Uncontrolled	8
	Cement plants			
	Dry process (for all processes)	Below detection limit of analytical technique	Uncontrolled	8
	Wet process			
	Kiln (average of two)	0.1 lb/1000 ton of feed	ESP	8

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Vanadium (V) (continued)	Clinker cooler	0.0005 lb/1000 ton of feed	Baghouse	8
		0.02 lb/1000 ton of feed	ESP	8
		Below detection limit of analytical technique	Two baghouse collections in parallel	8
	Finishing mill after air separator	0.0002 lb/1000 ton of feed	Baghouse	8
	Coal combustion	0.0003 - 0.004 lb/ton	10 - 20 ppm V content; ESP (lower end of factor range). Wet scrubber (upper end of factor range).	8
	Oil combustion -			
	U.S. crude oils	0.0007 - 0.6 lb/1000 gal	0.1 - 78 ppm V content; uncontrolled	8
	U.S. residual, average	0.2 lb/1000 gal	30 ppm V content; uncontrolled	8
	Foreign crude oils, average	0.8 - 3 lb/1000 gal	116 - 356 ppm V content; uncontrolled	8
	Foreign residual oils, average	0.4 - 2 lb/1000 gal	50 - 280 ppm V content; uncontrolled	8
	U.S. boilers -			
	Distillate units	0.00007 lb/1000 gal		8
	#6 Residual units	0.3 lb/1000 gal	223 ppm V content; uncontrolled	8
	#5 Residual units	0.09 lb/1000 gal	88 ppm V content; uncontrolled	8
	#4 Residual units	0.2 lb/1000 gal	86 ppm V content; uncontrolled	8
	Solid waste incineration	0.001 lb/ton of waste burned	Uncontrolled	8
	Coal combustion - utility boilers -			
	Pulverized dry bottom, bituminous coal	39.4 pg/J heat input	ESP	7
		62.8 pg/J heat input	Scrubber	7
		110 pg/J heat input	Uncontrolled	7
	Pulverized wet bottom, bituminous coal	32.3 pg/J heat input	ESP	7
	Cyclone, bituminous coal	30.1 pg/J heat input	ESP	7
		30.0 pg/J heat input	Scrubber	7
	Stoker, bituminous coal	24.9 pg/J heat input	Multicyclones	7
	Pulverized, anthracite coal	59.3 pg/J heat input	ESP	7
	Stoker, anthracite coal	24.9 pg/J heat input	Multicyclones	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Vanadium (V) (continued)	Pulverized dry bottom, lignite coal	17.5 pg/J heat input	ESP	7
	Pulverized wet bottom, lignite coal	0.01 pg/J heat input	ESP	7
	Cyclone, lignite coal	233 pg/J heat input 291 pg/J heat input	ESP Multicyclones	7 7
	Stoker, lignite coal	24.9 pg/J heat input	Multicyclones	7
	Oil combustion - utility boilers -			
	Tangential, residual oil	3.3 pg/J heat input 1516 pg/J heat input	ESP Uncontrolled	7 7
	Wall, residual oil	3.3 pg/J heat input 1516 pg/J heat input	ESP Uncontrolled	7 7
	Coal combustion - industrial boilers -			
	Pulverized, coal	33.0 pg/J heat input 24.0 pg/J heat input	Multicyclones Scrubber	7 7
	Stoker, coal	24.9 pg/J heat input 58.1 pg/J heat input	Multicyclones Uncontrolled	7 7
	Oil combustion - industrial boilers -			
	Tangential	260 pg/J heat input 1000 pg/J heat input	Scrubber Uncontrolled	7 7
	Wall	260 pg/J heat input 1000 pg/J heat input	Scrubber Uncontrolled	7 7
	Coal combustion - commercial boilers -			
	Stoker, coal	51.8 pg/J heat input	Uncontrolled	7
	Oil combustion - commercial boilers -			
	Tangential, residual oil	3660 pg/J heat input	Uncontrolled	7
	Wall, residual oil	3660 pg/J heat input	Uncontrolled	7

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Vanadium (V) (continued)	Tangential, distillate oil	30.0 pg/J heat input	Uncontrolled	7
	Wall, distillate oil	30.0 pg/J heat input	Uncontrolled	7
	Coal combustion - residential boilers -			
	All furnaces, bituminous coal	71.8 pg/J heat input	Uncontrolled	7
	All furnaces, anthracite coal	56.2 pg/J heat input	Uncontrolled	7
	All furnaces, lignite coal	34.4 pg/J heat input	Uncontrolled	7
	Oil combustion - residential boilers -			
	All furnaces, distillate oil	10.1 pg/J heat input	Uncontrolled	7
Vinylidene chloride	Vinylidene chloride production -			
	Reactor vent	6.2 kg/Mg produced	Uncontrolled	24
		0.12 kg/Mg produced	Incinerator	24
	Distillation vents	0.7 kg/Mg produced	Uncontrolled	24
		0.070 kg/Mg produced	Controlled	24
	Storage/handling	0.056 kg/Mg produced	Controlled	24
	Fugitives	0.96 kg/hr	Uncontrolled	24
		0.12 - 0.76 kg/hr	Controlled	24
	Perchloroethylene/trichloroethylene production -			
	Chlorination:			
	Neutralization vent	2.5 kg/Mg produced	Uncontrolled	24
		0.5 kg/Mg produced	Refrigerated condenser	24
	Distillation vent	0.106 kg/Mg produced	Uncontrolled	24
		0.021 kg/Mg produced	Refrigerated condenser	24
	Oxychlorination:			
	Reactor vent	3.8 kg/Mg produced	Uncontrolled	24
		0.076 kg/Mg produced	Thermal oxidation	24
	Drying column vent	0.4 kg/Mg produced	Uncontrolled	24
		0.008 kg/Mg produced	Thermal oxidation	24

TABLE H. EMISSION FACTORS FOR TOXIC AIR POLLUTANTS (Continued)

Pollutant	Process	Emission Factor	Notes	Reference
Vinylidene chloride (continued)	Distillation vent	0.098 kg/Mg produced	Uncontrolled	24
		0.020 kg/Mg produced	Scrubber	24
	Vinylidene chloride polymerization -			
	Reactor	3.5 kg/Mg polymerized		24
	Monomer recovery	0.33 kg/Mg polymerized		24
	Unloading/storage	2.1 kg/Mg polymerized		24
	Fugitive	2.8 - 11 kg/Mg polymerized		24
	High-vinylidene chloride copolymer fabrication processes -			
	Celophane coating	10 - 120 g/Mg		24
	Latex coating	50 - 1500 g/Mg		24
	Extrusion	2 - 25 g/Mg		24

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24. U. S. Environmental Protection Agency. Locating and Estimating Air Emissions from Sources of Vinylidene Chloride. EPA 450/4-84-007k. September 1985.

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APPENDIX I

VOC APPORTIONMENT FACTORS

APPENDIX I

SCC Index File And VOC Profile File Developed For National Acid Precipitation Assessment Program (NAPAP)

Tables I-1 and I-2, respectively, provide the SCC Index File and VOC Profile File developed for NAPAP. Table I-1 associates the SCC (Source Classification Code, used in EPA's NEDS and EIS inventory data systems) with a VOC profile key in Table I-2. Table I-2 presents the individual VOC species associated with each VOC profile key along with the weight percent and SAROAD identification code of each compound. (The right hand column of numbers in Table I-2 should be ignored, except to note that when the card code is "2," the corresponding row of information in Table I-2 gives information unrelated to VOC species. Hence, the "2" rows can be ignored for VOC apportioning purposes.)

To use these data, one would start with Table I-1 and identify a profile key associated with an SCC of interest. One would then go to Table I-2 and locate this profile key. The weight percent of any given compound present in the VOC emissions from that SCC would be read and could be applied to the total VOC emissions (from the inventory or permit file) to determine emissions of that particular compound.

An example application of VOC apportioning factors using Tables I-1 and I-2 is shown in Appendix A.

NOTE: In NAPAP, area sources have been defined by SCCs 99999901-99999954, profiles for which are shown on page I-6 of this appendix. Because these area source SCC designations are not used in NEDS or EIS, definitions for them are included in Table I-3 on page I-37. Definitions of the other SCCs in Table I-1 are found in the report entitled NEDS Source Classification Codes and Emission Factor Listing. (No EPA number.) U. S. Environmental Protection Agency, Research Triangle Park, North Carolina, 27711. October, 1985. (Available through EPA's National Air Data Branch at (FTS) 629-5694 or (919) 541-5694.)

CAUTION: Because the data in Tables I-1 and I-2 were not developed for air toxics applications, they have several weaknesses: (1) they underrepresent many chemical manufacturing operations, particularly those in the synthetic organic chemical manufacturing industry (SOCMI), and (2) they do not cover many of the more potent but less commonly emitted substances such as phosgene, epichlorohydrin, dioxin, acrylonitrile, etc. And, of course, these profiles do not cover metals. These apportioning factors are probably most useful for estimating air toxics emissions from minor industrial sources and area sources. EPA plans to update these data in 1987 and extend their applicability to air toxics.

TABLE I-1 THE NAPAP EMISSION INVENTORY SPECIES INDEX FILE

SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY
		10200602	K0003	20100201	K0007	30101840	K0067
10100102	K0003	10200603	K0003	20100202	K0010	30101891	K0067
10100201	R0001	10200701	K0004	20100301	K0008	30101899	K0068
10100202	R0001	10200702	K0004	20100302	K0008	30101901	K0276
10100203	R0001	10200704	K0004	20100501	K0008	30101902	K0276
10100204	R0001	10200705	K0004	20100901	K0009	30101903	K0071
10100205	R0001	10200707	K0005	20100902	K0009	30101904	K0276
10100209	R0001	10200708	K0005	20200101	K0009	30102005	K0072
10100221	R0001	10200799	K0004	20200102	K0009	30102099	K0072
10100222	R0001	10200802	K0005	20200201	K0007	30102301	C0015
10100223	R0001	10200901	K0003	20200202	K0010	30102399	C0015
10100301	R0001	10200902	K0003	20200301	K0009	30102401	K0067
10100303	R0001	10200903	K0003	20300101	K0008	30102402	K0068
10100306	R0001	10201002	K0003	20300201	K0010	30102406	K0079
10100299	R0001	10201201	K0003	20400101	K0010	30102410	K0274
10100401	K0001	10201301	K0002	20400402	K0009	30102414	K0068
10100402	K0001	10201302	K0002	20400499	C0061	30102499	K0274
10100404	K0001	10299997	K0005	29999999	K0007	30102501	K0067
10100504	K0002	10299998	K0005	30100101	K0071	30102505	K0067
10100501	K0002	10300101	K0003	30100106	C0015	30102599	K0067
10100505	K0002	10300102	R0001	30100503	K0079	30102601	K0272
10100601	K0003	10300205	R0001	30100504	K0079	30102602	K0272
10100602	K0003	10300207	R0001	30100505	C0015	30102606	K0272
10100604	K0003	10300208	R0001	30100599	K0079	30102620	K0272
10100702	K0004	10300209	K0003	30100601	K0079	30102699	K0274
10100801	K0005	10300210	R0001	30100699	K0079	30103201	C0017
10100901	K0001	10300211	R0001	30100701	K0078	30103202	C0017
10100902	K0001	10300212	R0001	30100799	K0079	30103301	C0017
10100903	K0003	10300213	R0001	30100901	K0078	30103399	C0024
10200104	K0003	10300214	R0001	30100902	K0079	30103401	C0015
10200107	K0003	10300299	R0001	30100910	K0079	30103410	C0015
10200201	R0001	10300401	K0001	30100999	K0079	30103499	C0015
10200202	R0001	10300402	K0001	30101101	C0015	30103599	K0079
10200203	R0001	10300403	K0001	30101199	C0015	30103601	C0017
10200204	R0001	10300501	K0002	30101301	K0079	30103999	C0015
10200205	K0001	10300502	K0002	30101399	K0079	30104101	C0015
10200206	R0001	10300503	K0002	30101401	K0079	30104104	C0015
10200206	R0001	10300601	K0003	30101402	K0066	30104199	C0015
10200209	R0001	10300602	K0003	30101499	K0079	30105001	K0079
10200210	R0001	10300603	K0003	30101501	K0066	30106001	C0015
10200211	K0003	10300901	R0001	30101502	K0066	30106002	C0015
10200212	R0001	10300902	R0001	30101503	K0065	30106004	C0015
10200213	K0003	10300903	R0001	30101505	K0065	30106005	C0015
10200214	R0001	10399997	C0049	30101599	K0066	30106006	C0015
10200299	R0001	10500102	K0002	30101612	C0017	30106007	C0015
10200401	K0001	10500105	K0002	30101800	K0067	30106009	C0015
10200402	K0001	10500106	K0003	30101801	K0067	30106010	C0015
10200403	K0001	10500202	K0002	30101802	K0066	30106099	K0079
10200404	K0001	10500205	K0002	30101805	K0066	30109099	K0079
10200501	K0002	10500501	K0002	30101807	K0172	30110001	C0017
10200502	K0002	10500601	K0003	30101812	K0172	30110099	C0017
10200503	K0002	19999999	K0079	30101827	K0066	30111001	K0079
10200504	K0002	20100101	K0009	30101836	K0067	30111002	K0274
10200601	K0003	20100102	K0009	30101839	K0067	30111199	K0079

Table I-1 (continued)

SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY
30112601	C0015	30201999	C0032	30400104	C0066	30500299	K0025
30112001	K0079	30203104	K0211	30400106	C0086	30500302	C0031
30112002	K0079	30203105	C0032	30400107	C0085	30500303	C0031
30112501	K0078	30203106	K0211	30400108	C0086	30500304	C0065
30112502	C0015	30203299	C0032	30400109	C0086	30500305	K0025
30112599	K0078	30203601	K0211	30400110	C0066	30500308	C0031
30113001	C0017	30210001	C0032	30400111	C0066	30500309	C0031
30113004	C0015	30299998	C0032	30400150	C0066	30500311	K0026
30113299	C0015	30299999	C0032	30400199	C0086	30500312	K0002
30113799	C0015	30300001	C0065	30400217	C0086	30500313	C0031
30125099	K0079	30300102	K0011	30400230	C0086	30500314	C0031
30125801	C0015	30300105	K0011	30400238	C0085	30500316	C0031
30125699	C0015	30300199	K0011	30400299	C0086	30500399	K0025
30126501	C0015	30300301	K0011	30400301	C0086	30500501	C0065
30130001	C0015	30300302	K0011	30400303	C0086	30500502	K0026
30181001	C0015	30300303	K0011	30400330	C0085	30500599	K0024
30186801	K0079	30300304	K0011	30400340	C0066	30500606	K0026
30190099	K0079	30300305	K0011	30400350	C0066	30500608	K0026
30199999	K0079	30300306	K0011	30400351	C0085	30500609	K0026
30200301	K0211	30300310	K0011	30400360	C0085	30500610	K0026
30200501	C0032	30300312	K0011	30400399	C0086	30500611	K0026
30200504	K0211	30300399	K0011	30400401	C0086	30500612	K0026
30200505	K0211	30300401	K0011	30400402	C0086	30500613	K0026
30200603	K0211	30300505	K0012	30400403	C0085	30500614	K0026
30200604	K0211	30300599	K0012	30400404	C0086	30500615	K0026
30200606	C0032	30300699	K0012	30400408	C0086	30500616	K0026
30200701	K0211	30300801	K0012	30400409	C0086	30500617	K0026
30200702	C0032	30300802	K0012	30400499	C0086	30500618	K0026
30200705	K0211	30300803	K0013	30400501	K0079	30500619	K0026
30200732	K0211	30300805	K0012	30400502	K0079	30500705	C0031
30200734	K0211	30300807	K0012	30400503	K0079	30500706	K0026
30200743	K0211	30300813	K0013	30400506	K0079	30500707	K0026
30200744	C0032	30300824	K0012	30400507	K0079	30500708	K0026
30200754	K0211	30300825	K0012	30400509	K0079	30500709	K0026
30200755	C0032	30300899	K0012	30400701	C0085	30500710	K0026
30200760	K0211	30300901	K0306	30400704	C0065	30500711	K0026
30200802	C0032	30300903	K0016	30400705	C0085	30500712	K0026
30200803	K0211	30300911	K0016	30400706	C0085	30500714	K0026
30200804	C0032	30300912	K0016	30400707	C0065	30500715	K0026
30200805	C0032	30300913	K0016	30400799	C0085	30500716	K0026
30200806	C0032	30300920	K0306	30400899	C0086	30500717	K0026
30200901	K0211	30300931	K0306	30402004	K0079	30500718	K0026
30200902	K0211	30300932	K0306	30402099	K0079	30500719	K0026
30200903	K0211	30300933	K0306	30402201	C0065	30500901	C0025
30200998	K0211	30300934	C0085	30405601	C0086	30500999	C0025
30200999	K0211	30300999	K0016	30499999	C0086	30501001	R0001
30201001	K0211	30303002	C0065	30500101	K0021	30501008	R0001
30201003	K0211	30303005	K0011	30500102	K0022	30501009	R0001
30201201	K0211	30303009	C0085	30500104	K0022	30501010	R0001
30201299	K0211	30303012	K0011	30500105	K0025	30501011	R0001
30201301	R0001	30399999	K0012	30500199	K0024	30501012	R0001
30201699	K0211	30400101	C0086	30500201	K0025	30501013	R0001
30201962	C0032	30400102	C0086	30500202	K0025	30501014	R0001
30201963	C0032	30400103	C0086	30500205	K0025	30501015	R0001

Table I-1 (continued)

SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY
40191302	C0026	40200909	K0220	40290302	C0044	40300304	K0100
40191303	K0085	40200910	K0226	40290304	K0096	40300305	C0091
40191304	C0026	40200911	K0095	40290305	C0044	40300306	K0298
40199999	K0090	40200912	K0227	40290306	C0044	40300310	C0094
40200101	K0125	40200913	K0228	40290404	C0044	40300312	K0231
40200102	K0219	40200915	K0229	40290601	K0056	40300398	C0091
40200103	K0220	40200916	X0008	40290603	C0044	40300399	K0232
40200110	K0125	40200917	K0291	40290604	K0096	40301001	K0098
40200199	K0141	40200918	K0221	40290701	K0096	40301002	K0098
40200201	K0066	40200919	X0005	40290702	C0044	40301003	K0098
40200205	K0219	40200920	K0221	40290703	C0044	40301007	K0098
40200210	C0110	40200921	K0282	40290806	C0044	40301009	K0098
40200299	C0111	40200922	K0090	40290809	C0044	40301010	K0297
40200301	K0127	40200924	K0223	40299998	K0254	40301012	K0297
40200310	K0127	40200925	K0096	40299999	K0293	40301015	K0100
40200399	K0127	40200998	K0096	40300002	K0098	40301016	K0100
40200401	K0146	40201001	K0220	40300101	K0099	40301018	K0100
40200402	K0149	40201101	K0096	40300102	K0296	40301020	K0100
40200403	K0149	40201103	K0162	40300103	K0099	40301097	C0091
40200406	K0162	40201301	K0096	40300104	K0297	40301099	K0098
40200410	K0147	40201399	K0149	40300105	K0100	40301101	K0098
40200499	K0147	40201601	K0092	40300106	K0297	40301102	K0098
40200501	K0156	40201606	K0096	40300107	K0297	40301103	C0094
40200502	K0156	40201702	C0044	40300108	K0298	40301104	C0094
40200503	K0156	40201705	K0134	40300111	K0231	40301105	C0094
40200504	K0156	40201722	K0134	40300112	K0230	40301106	C0094
40200505	K0156	40201723	K0134	40300113	K0100	40301108	C0094
40200510	K0156	40201725	K0134	40300114	K0100	40301109	K0098
40200599	K0156	40201726	K0096	40300116	K0185	40301110	K0098
40200601	K0260	40201727	K0056	40300117	K0100	40301111	C0094
40200603	K0134	40201728	K0134	40300119	K0100	40301112	C0094
40200604	K0134	40201799	K0134	40300121	K0100	40301113	K0100
40200610	K0134	40201801	K0095	40300150	K0100	40301115	C0091
40200699	K0134	40201806	K0134	40300151	K0296	40301117	K0297
40200701	K0141	40201901	K0162	40300152	K0100	40301197	C0094
40200705	K0221	40202001	X0010	40300153	K0298	40301198	C0094
40200706	K0141	40202101	K0096	40300157	K0230	40301199	C0094
40200710	K0267	40202103	K0096	40300160	K0303	40301202	K0099
40200799	K0145	40202106	K0096	40300161	K0165	40301204	K0100
40200801	K0092	40202107	K0157	40300198	K0188	40301206	K0100
40200802	K0092	40202108	K0096	40300199	K0100	40301299	K0098
40200803	K0279	40202109	K0096	40300201	K0098	40302001	C0091
40200810	K0092	40202199	K0096	40300202	K0098	40309103	K0058
40200821	K0092	40202301	K0092	40300203	K0297	40388801	C0091
40200898	K0056	40202306	K0056	40300204	K0297	40399999	K0100
40200899	K0162	40202401	K0134	40300205	K0100	40400101	K0098
40200901	K0096	40202406	K0134	40300206	K0297	40400102	K0099
40200902	K0219	40202501	K0095	40300207	K0297	40400103	K0099
40200903	K0288	40202502	C0044	40300208	K0298	40400104	K0098
40200904	K0289	40202599	X0011	40300211	C0094	40400107	K0099
40200905	K0096	40288801	K0293	40300212	K0230	40400108	K0098
40200906	K0293	40290101	K0056	40300216	K0185	40400109	K0096
40200907	K0222	40290104	K0096	40300299	K0100	40400110	K0099
40200908	K0292	40290106	K0056	40300302	K0058	40400111	K0099

Table I-1 (continued)

SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY
30501024	C0031	30503099	K0024	30700101	C0025	32099199	K0060
30501099	R0001	30503101	C0031	30700103	C0025	32099996	C0090
30501107	K0025	30503104	C0031	30700104	C0025	32099999	K0060
30501108	K0025	30503105	C0031	30700106	K0211	33000101	K0060
30501110	K0025	30503107	C0031	30700199	C0025	33000102	K0060
30501111	C0031	30503110	C0031	30700221	C0025	33000103	K0060
30501120	K0031	30503202	C0031	30700299	C0025	33000199	K0060
30501201	C0031	30503203	C0031	30700301	C0025	33000201	K0060
30501203	C0031	30503204	C0031	30700401	C0025	33000202	K0060
30501204	C0031	30503205	C0031	30700402	C0025	33000203	K0060
30501205	K0024	30503206	C0031	30700499	K0149	33000299	K0066
30501215	C0031	30503295	C0031	30700501	C0025	33000399	K0060
30501299	C0031	30504023	C0066	30700701	C0025	39000199	K0217
30501399	K0025	30504025	C0031	30700702	C0025	39000201	K0217
30501401	K0025	30504030	K0211	30700703	C0025	39000203	K0217
30501403	K0211	30504034	C0031	30700799	C0025	39000299	K0217
30501404	C0031	30504099	C0031	30700804	C0025	39000402	K0001
30501406	C0031	30510002	C0031	30700899	C0025	39000403	K0001
30501406	C0031	30510003	C0031	30701199	K0096	39000406	K0001
30501410	K0211	30510004	C0031	30702099	K0053	39000499	K0001
30501411	C0031	30599999	C0031	30703001	C0025	39000501	K0002
30501499	K0025	30600101	K0029	30703002	C0025	39000502	K0002
30501503	K0025	30600102	K0003	30703099	C0025	39000599	K0002
30501601	K0025	30600103	K0001	30799999	C0025	39000608	K0003
30501602	K0025	30600104	K0003	30788801	C0025	39000690	K0003
30501603	K0211	30600105	K0003	30800101	K0272	39000699	K0003
30501604	K0211	30600201	K0029	30800102	K0274	39000701	K0217
30501605	K0211	30600301	K0029	30800105	K0274	39000702	K0005
30501606	K0211	30600401	K0029	30800106	K0273	39000797	K0217
30501607	K0025	30600402	K0053	30800107	K0274	39000798	K0005
30501608	K0025	30600501	K0031	30800108	K0272	39000799	K0217
30501610	K0025	30600502	K0053	30800197	K0079	39000801	K0005
30501611	K0025	30600503	K0168	30800198	K0272	39001099	R0061
30501614	K0025	30600504	K0168	30800199	K0067	39099997	K0003
30501616	K0025	30600602	K0031	30800699	K0272	39099999	K0003
30501699	K0025	30600603	K0029	30800799	K0067	39999999	K0029
30501701	C0066	30600701	K0035	30899245	K0274	40100101	K0085
30501859	K0025	30600702	K0035	30900001	C0005	40100102	K0086
30501902	K0211	30600801	K0316	30900199	C0066	40100103	K0085
30501903	C0031	30600802	K0047	30900201	C0065	40100104	K0086
30502001	C0031	30600803	K0321	30900205	C0065	40100105	K0068
30502002	C0031	30600804	K0039	30900299	C0005	40100199	K0087
30502003	C0031	30600805	K0031	30901001	C0005	40100201	K0066
30502004	C0031	30600806	K0029	30901099	C0005	40100202	K0067
30502005	C0031	30600807	K0029	30901102	K0016	40100203	K0085
30502006	C0031	30600901	K0051	30902099	C0085	40100204	K0275
30502007	C0031	30600999	K0051	30903001	C0005	40100205	K0271
30502008	C0031	30601101	K0053	30903002	C0005	40100206	K0090
30502009	C0031	30601201	K0038	30903003	C0035	40100207	K0086
30502010	C0031	30601613	K0029	30903004	C0035	40100225	K0271
30502011	C0031	30688801	K0038	30903005	C0065	40100299	K0063
30502101	C0031	30699995	K0053	30903099	C0065	40100366	K0277
30502501	C0031	30699996	K0053	30988801	C0065	40188801	K0068
30502601	C0031	30699999	K0029	30999999	C0065	40188896	K0085

Table I-1 (continued)

SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY	SCC	PROFILE KEY
40400112	C0094	40600132	K0297	50190006	C0051	99999923	K0121
40400113	C0094	40600133	K0160	50190010	C0051	99999924	X0002
40400114	C0094	40600134	K0098	50200101	K0122	99999925	X0002
40400116	C0094	40600135	K0096	50200102	K0121	99999926	X0002
40400118	K0098	40600136	K0056	50200103	K0121	99999927	X0002
40400119	C0091	40600137	K0297	50200104	C0051	99999928	X0002
40400153	C0091	40600138	K0100	50200105	C0051	99999929	X0002
40400156	C0091	40600140	K0100	50200106	K0003	99999930	C0038
40400161	C0091	40600141	K0098	50200201	K0121	99999931	C0034
40400199	K0098	40600143	K0100	50200301	C0051	99999932	C0034
40400201	K0096	40600144	C0010	50200399	K0121	99999933	K0330
40400202	K0096	40600145	K0100	50200505	K0262	99999934	C0004
40400204	C0091	40600146	K0257	50200506	K0203	99999935	C0020
40400205	K0096	40600147	C0010	50200599	K0121	99999936	C0020
40400207	K0093	40600151	C0010	50290005	K0121	99999937	C0020
40400212	K0093	40600197	C0010	50290006	K0003	99999938	C0120
40400250	K0098	40600198	C0010	50300101	K0122	99999939	C0120
40401199	C0091	40600199	C0010	50300102	C0051	99999940	C0121
40401999	C0091	40600236	K0305	50300103	C0051	99999941	X0007
40499999	C0091	40600240	K0303	50300104	K0121	99999942	X0006
40500101	K0334	40600241	K0305	50300105	C0051	99999943	K0307
40500159	K0334	40600243	K0297	50300106	K0121	99999944	K0121
40500201	K0334	40600244	K0100	50300108	C0051	99999945	K0121
40500202	K0096	40600246	K0100	50300201	K0121	99999946	K0121
40500203	K0283	40600248	K0257	50300202	K0121	99999947	K0069
40500299	K0166	40600249	K0100	50300203	C0051	99999948	K0069
40500301	K0172	40600251	K0160	50300506	K0121	99999949	K0069
40500303	K0250	40600253	K0305	50300599	K0122	99999950	K0089
40500304	K0226	40600301	C0010	50390006	C0051	99999951	K0089
40500305	K0172	40600302	C0010	50390010	C0051	99999952	K0089
40500306	K0172	40600303	C0010	59999999	C0116	99999953	K0089
40500307	K0282	40600305	C0010	63199998	K0195	99999954	K0089
40500311	K0172	40600306	C0010	99999901	R0001		
40500401	K0333	40600307	C0010	99999902	R0001		
40500499	K0333	40600399	C0010	99999903	K0002		
40500501	K0181	40600401	C0010	99999904	K0003		
40500503	K0220	40600402	C0010	99999905	K0121		
40500506	K0221	40600403	C0010	99999906	R0001		
40500507	K0221	40600499	C0010	99999907	R0001		
40500510	K0095	40688801	K0305	99999908	K0002		
40500511	K0181	40999999	C0010	99999909	K0001		
40500598	K0182	49000105	K0027	99999910	K0003		
40500599	K0182	49000159	K0069	99999911	K0121		
40500601	X0012	49000295	X0063	99999912	R0001		
40589101	C0113	49099999	X0063	99999913	R0001		
40588801	K0182	50100101	K0122	99999914	K0002		
40600101	C0010	50100102	K0122	99999915	K0001		
40600104	K0100	50100199	C0051	99999916	K0003		
40600105	K0100	50100201	K0121	99999917	K0121		
40600126	C0010	50100202	K0121	99999918	C0051		
40600127	C0010	50100506	K0203	99999919	C0051		
40600129	C0010	50100507	C0051	99999920	C0051		
40600130	K0100	50100599	K0122	99999921	K0121		
40600131	K0056	50190005	C0051	99999922	K0121		

TABLE I-2 VOC Profile Key and VOC Species(weight percent)

Profile Key	Saroad Code	Weight Percent	Molecular Weight[a]		Card Code[b]
C0004	43201	1.96	16.04	METHANE	13
C0004	43203	6.15	28.05	ETHYLENE	23
C0004	43205	1.71	42.08	PROPYLENE	33
C0004	43206	0.65	26.04	ACETYLENE	43
C0004	43215	0.89	56.12	ISOBUTYLENE	53
C0004	43224	3.79	70.14	1-PENTENE	63
C0004	43232	0.23	100.21	N-HEPTANE	73
C0004	43235	1.30	128.26	N-NONANE	83
C0004	43238	1.93	142.29	N-DECANE	93
C0004	43241	4.05	156.32	N-UNDECANE	103
C0004	43255	7.32	170.34	N-DODECANE	113
C0004	43258	6.04	184.37	N-TRIDECANE	123
C0004	43259	6.50	198.40	N-TETRADECANE	133
C0004	43260	6.00	212.42	N-PENTADECANE	143
C0004	43281	5.37	226.45	N-HEXADECANE	153
C0004	43282	3.60	240.48	N-HEPTADECANE	163
C0004	43283	3.16	254.51	N-OCTADECANE	173
C0004	43284	2.43	268.53	N-NONADECANE	183
C0004	43285	2.55	282.56	N-EICOSANE	193
C0004	43286	1.34	296.59	N-HENEICOSANE	203
C0004	43287	0.70	310.61	N-DOCOSANE	213
C0004	43502	5.16	30.03	FORMALDEHYDE	223
C0004	43503	14.80	44.05	ACETALDEHYDE	233
C0004	45202	0.21	92.15	TOLUENE	243
C0004	45207	0.27	120.19	1,3,5-TRIMETHYLBENZENE	253
C0004	45221	11.42	118.15	A-METHYLSTYRENE	263
C0005	00.00	00.00	09.36	C0005	2
C0005	43105	.42	86.18	ISOMERS OF HEXANE	13
C0005	43106	.11	100.21	ISOMERS OF HEPTANE	23
C0005	43107	.20	114.23	ISOMERS OF OCTANE	33
C0005	43122	2.05	72.15	ISOMERS OF PENTANE	43
C0005	43201	27.77	16.04	METHANE	53
C0005	43202	.03	30.07	ETHANE	63
C0005	43204	1.30	44.09	PROPANE	73
C0005	43205	3.97	42.08	PROPYLENE	83
C0005	43206	.51	26.04	ACETYLENE	93
C0005	43212	2.59	58.12	N-BUTANE	103
C0005	43213	1.45	56.10	BUTENE	113
C0005	43214	.21	58.12	ISOBUTANE	123
C0005	43220	2.39	72.15	N-PENTANE	133
C0005	43224	4.04	70.14	1-PENTENE	143
C0005	43231	.47	86.18	N-HEXANE	153
C0005	43232	.01	100.21	N-HEPTANE	163
C0005	43248	.20	84.16	CYCLOHEXANE	173
C0005	43301	1.09	32.04	METHYL ALCOHOL	183
C0005	43302	.87	46.07	ETHYL ALCOHOL	193
C0005	43304	3.18	60.09	ISOPROPYL ALCOHOL	203
C0005	43305	4.56	74.12	N-BUTYL ALCOHOL	213
C0005	43502	9.36	30.03	FORMALDEHYDE	223
C0005	43551	13.14	58.08	ACETONE	233
C0005	43552	13.02	72.10	METHYL ETHYL KETONE	243
C0005	43560	5.17	100.16	METHYL ISOBUTYL KETONE	253
C0005	45101	.69	114.00	NAPHTHA	263
C0005	45201	.31	78.12	BENZENE	273
C0005	45202	.40	92.15	TOLUENE	283
C0010			00.03	C0010	2
C0010	43201	83.53	16.04	METHANE	13
C0010	43202	10.94	30.07	ETHANE	23
C0010	43203	.03	28.05	ETHYLENE	33
C0010	43204	3.81	44.09	PROPANE	43

a. Of each substance. Weight percents for all substances within a profile should equal 100 percent.

b. See page I-1 for discussion.

Table I-2 (continued)

C0010	43212	.52	58.12	N-BUTANE	53
C0010	43214	.42	58.12	ISOBUTANE	63
C0010	43220	.10	72.15	N-PENTANE	73
C0010	43231	.10	86.18	N-HEXANE	83
C0010	43232	.10	100.21	N-HEPTANE	93
C0010	43248	.10	84.16	CYCLOHEXANE	103
C0010	43108	.03	128.26	ISOMERS OF NONANE	113
C0010	43109	.07	142.29	ISOMERS OF DECANE	123
C0010	43122	.10	72.15	ISOMERS OF PENTANE	133
C0010	43301	.01	32.04	METHYL ALCOHOL	143
C0010	43302	.01	46.07	ETHYL ALCOHOL	153
C0010	43304	.01	60.09	ISOPROPYL ALCOHOL	163
C0010	43502	.03	30.03	FORMALDEHYDE	173
C0010	43551	.02	58.08	ACETONE	183
C0010	43552	.02	72.10	METHYL ETHYL KETONE	193
C0010	43560	.01	100.16	METHYL ISOBUTYL KETONE	203
C0010	43617	.02	165.83	PERCHLOROETHYLENE	213
C0010	45102	.01	106.17	ISOMERS OF XYLENE	223
C0010	45202	.01	92.15	TOLUENE	233
C0015			00.48	C0015	2
C0015	43201	1.26	16.04	METHANE	13
C0015	43202	.47	30.07	ETHANE	23
C0015	43203	6.10	28.05	ETHYLENE	33
C0015	43205	3.75	42.08	PROPYLENE	43
C0015	43206	.28	26.04	ACETYLENE	53
C0015	43213	1.16	56.10	BUTENE	63
C0015	43231	7.61	86.18	N-HEXANE	73
C0015	43232	.22	100.21	N-HEPTANE	83
C0015	43233	.04	114.23	N-OCTANE	93
C0015	43105	.01	86.18	ISOMERS OF HEXANE	103
C0015	43106	.63	100.21	ISOMERS OF HEPTANE	113
C0015	43107	.06	114.23	ISOMERS OF OCTANE	123
C0015	43248	3.89	84.16	CYCLOHEXANE	133
C0015	43115	5.66	98.19	C-7 CYCLOPARAFFINS	143
C0015	43116	.76	112.23	C-8 CYCLOPARAFFINS	153
C0015	43118	1.47	114.00	MINERAL SPIRITS	163
C0015	43120	2.52	56.10	ISOMERS OF BUTENE	173
C0015	43301	1.59	32.04	METHYL ALCOHOL	163
C0015	43302	.44	46.07	ETHYL ALCOHOL	193
C0015	43304	.92	60.09	ISOPROPYL ALCOHOL	203
C0015	43305	.37	74.12	N-BUTYL ALCOHOL	213
C0015	43367	.42	62.07	GLYCOL ETHER	223
C0015	43368	.34	62.07	GLYCOL	233
C0015	43433	.52	88.10	ETHYL ACETATE	243
C0015	43435	.18	116.16	N-BUTYL ACETATE	253
C0015	43438	.23	100.11	ETHYL ACRYLATE	263
C0015	43444	.02	104.00	ISOPRORYL ACETATE	273
C0015	43502	.48	30.03	FORMALDEHYDE	283
C0015	43503	.20	44.05	ACETALEHYDE	293
C0015	43510	.23	72.12	BUTYRALDEHYDE	303
C0015	43551	21.45	58.08	ACETONE	313
C0015	43552	1.03	72.10	METHYL ETHYL KETONE	323
C0015	43560	.41	100.16	METHYL ISOBUTYL KETONE	333
C0015	43601	1.30	44.05	ETHYLENE OXIDE	343
C0015	43602	.40	58.08	PROPYLENE OXIDE	353
C0015	43704	.85	55.06	ACRYLONITRILE	363
C0015	43801	.25	50.49	METHYL CHLORIDE	373
C0015	43812	2.04	64.52	ETHYL CHLORIDE	383
C0015	43815	7.00	99.00	ETHYLENE DICHLORIDE	393
C0015	43817	3.65	165.83	PERCHLOROETHYLENE	403
C0015	43819	.01	173.85	METHYLENE BROMIDE	413
C0015	43860	.58	62.50	VINYL CHLORIDE	423

Table I-2 (continued)

```
C0015  45101       10.99    114.00  NAPTHA                               433
C0015  45102         .62    106.17  ISOMERS OF XYLENE                    443
C0015  45201        3.21     78.12  BENZENE                              453
C0015  45202        2.33     92.15  TOLUENE                              463
C0015  45220         .96    104.16  STYRENE                              473
C0015  45106         .01    134.22  ISOMERS OF DIETHYLBENZENE            483
C0015  45300         .57     94.11  PHENOLS                              493
C0015  45401         .37    230.00  XYLENE BASE ACIDS                    503
C0017                               C0017                                  2
C0017  43000      100.00     86.00  UNIDENTIFIED HYDROCARBONS             13
C0020     97.00   3.00  00.00    C0020                                     2
C0020  43202        1.86     30.07  ETHANE                                13
C0020  43206        0.23     26.04  ACETYLENE                             23
C0020  43235       24.98    128.26  N-NONANE                              33
C0020  43290       19.67    113.24  C8 OLEFIN UNK                         43
C0020  43513       11.35     29.00  ALDEHYDE                              53
C0020  45102       15.04    106.17  ISOMERS OF XYLENE                     63
C0020  45201        0.69     78.12  BENZENE                               73
C0020  45215        4.75    134.22  TERT-BUTYLBENZENE                     83
C0020  45104       15.97    120.19  ISOMERS OF ETHYLTOLUENE               93
C0020  45233        5.25    219.50  TRI/TETRAALKYL BENZENE               103
C0024                   00.00     C0024                                    2
C0024  43204        1.80     44.09  PROPANE                               13
C0024  43212        4.40     58.12  N-BUTANE                              23
C0024  43214        1.40     58.12  ISOBUTANE                             33
C0024  43220        3.20     72.15  N-PENTANE                             43
C0024  43231        3.70     86.18  N-HEXANE                              53
C0024  43105        8.10     86.18  ISOMERS OF HEXANE                     63
C0024  43115       15.40     98.19  C-7 CYCLOPARAFFINS                    73
C0024  43116        1.60    112.23  C-8 CYCLOPARAFFINS                    83
C0024  43118       15.00    114.00  MINERAL SPIRITS                       93
C0024  43122        3.10     72.15  ISOMERS OF PENTANE                   103
C0024  43819       10.00    173.85  METHYLENE BROMIDE                    113
C0024  45102       15.00    106.17  ISOMERS OF XYLENE                    123
C0024  45201       12.30     78.12  BENZENE                              133
C0024  45202        5.00     92.15  TOLUENE                              143
C0025                               C0025                                  2
C0025  43000      100.00     86.00  UNIDENTIFIED HYDROCARBONS             13
C0026                   00.60     C0026                                    2
C0026  43214        5.30     58.12  ISOBUTANE                             13
C0026  43302       36.90     46.07  ETHYL ALCOHOL                         23
C0026  43304       38.50     60.09  ISOPROPYL ALCOHOL                     33
C0026  43367        8.30     62.07  GLYCOL ETHER                          43
C0026  43369        3.20     76.00  PROPYLENE GLYCOL                      53
C0026  43435        1.30    116.16  N-BUTYL ACETATE                       63
C0026  43502         .60     30.03  FORMALDEHYDE                          73
C0026  43551        1.40     58.08  ACETONE                               83
C0026  45101        4.50    114.00  NAPHTHA                               93
C0031     95.00   5.00  00.42       C0031                                  2
C0031  43201       63.19     16.04  METHANE                               13
C0031  43202        1.84     30.07  ETHANE                                23
C0031  43203        1.55     28.05  ETHYLENE                              33
C0031  43204        2.56     44.09  PROPANE                               43
C0031  43205        1.41     42.08  PROPYLENE                             53
C0031  43206         .05     26.04  ACETYLENE                             63
C0031  43212        4.57     58.12  N-BUTANE                              73
C0031  43213        2.10     56.10  BUTENE                                83
C0031  43214        4.31     58.12  ISOBUTANE                             93
C0031  43220        2.75     72.15  N-PENTANE                            103
C0031  43231        3.25     86.18  N-HEXANE                             113
C0031  43232         .53    100.21  N-HEPTANE                            123
C0031  43105        3.39     86.18  ISOMERS OF HEXANE                    133
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Table I-2 (continued)

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C0031  43106          .43     100.21   ISOMERS OF HEPTANE                        143
C0031  43107          .06     114.23   ISOMERS OF OCTANE                         153
C0031  43248          .03      84.16   CYCLOHEXANE                               163
C0031  43115         1.32      98.19   C-7 CYCLOPARAFFINS                        173
C0031  43122         2.29      72.15   ISOMERS OF PENTANE                        183
C0031  43502          .42      30.03   FORMALDEHYDE                              193
C0031  43552          .02      72.10   METHYL ETHYL KETONE                       203
C0031  45101          .30     114.00   NAPTHA                                    213
C0031  45201         3.61      78.12   BENZENE                                   223
C0031  45202          .05      92.15   TOLUENE                                   233
C0032                      00.11     C0032                                         2
C0032  43201        92.36      16.04   METHANE                                    13
C0032  43203         1.37      28.05   ETHYLENE                                   23
C0032  43204          .19      44.09   PROPANE                                    33
C0032  43205          .42      42.08   PROPYLENE                                  43
C0032  43206          .13      26.04   ACETYLENE                                  53
C0032  43212          .26      58.12   N-BUTANE                                   63
C0032  43213          .42      56.10   BUTENE                                     73
C0032  43214          .13      58.12   ISOBUTANE                                  83
C0032  43220          .22      72.15   N-PENTANE                                  93
C0032  43224          .42      70.14   1-PENTENE                                 103
C0032  43231          .98      86.18   N-HEXANE                                  113
C0032  43232          .98     100.21   N-HEPTANE                                 123
C0032  43233          .97     114.23   N-OCTANE                                  133
C0032  43105          .01      86.18   ISOMERS OF HEXANE                         143
C0032  43248          .01      84.16   CYCLOHEXANE                               153
C0032  43121          .83      70.14   ISOMERS OF PENTENE                        163
C0032  43122          .12      72.15   ISOMERS OF PENTANE                        173
C0032  43502          .11      30.03   FORMALDEHYDE                              183
C0032  45201          .06      78.12   BENZENE                                   193
C0032  45202          .03      92.15   TOLUENE                                   203
C0034     90.00  10.00  05.26      C0034                                           2
C0034  43201         1.96      16.04   METHANE                                    13
C0034  43203         6.27      28.05   ETHYLENE                                   23
C0034  43205         1.74      42.08   PROPYLENE                                  33
C0034  43206         0.66      26.04   ACETYLENE                                  43
C0034  43215         0.91      56.12   ISOBUTYLENE                                53
C0034  43224         3.87      70.14   1-PENTENE                                  63
C0034  43232         0.23     100.21   N-HEPTANE                                  73
C0034  43235         1.33     128.26   N-NONANE                                   83
C0034  43238         1.97     142.29   N-DECANE                                   93
C0034  43241         4.14     156.32   N-UNDECANE                                103
C0034  43255         7.47     170.34   N-DODECANE                                113
C0034  43258         6.16     184.36   N-TRIDECANE                               123
C0034  43259         6.63     198.40   N-TETRADECANE                             133
C0034  43260         6.12     212.42   N-PENTADECANE                             143
C0034  43281         5.47     226.45   N-HEXADECANE                              153
C0034  43282         3.86     240.48   N-HEPTADECANE                             163
C0034  43283         3.22     254.51   N-OCTADECANE                              173
C0034  43284         2.48     268.53   N-NONADECANE                              183
C0034  43285         2.60     282.56   N-EICOSANE                                193
C0034  43286         1.36     296.59   N-HENEICOSANE                             203
C0034  43287         0.71     310.61   N-DOCOSANE                                213
C0034  43502         5.26      30.03   FORMALDEHYDE                              223
C0034  43503        15.10      44.05   ACETALDEHYDE                              233
C0034  45202         0.21      92.15   TOLUENE                                   243
C0034  45207         0.28     120.19   1,3,5-TRIMETHYLBENZENE                    253
C0034  45221        11.65     118.15   A-METHYLSTYRENE                           263
C0035                                C0035                                         2
C0035  43000       100.00      86.00   UNIDENTIFIED HYDROCARBONS                  13
C0038     90.00  10.00                 C0038                                       2
C0038  43201         4.22      16.04   METHANE                                    13
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Table I-2 (continued)

C0038	43202	3.16	30.07	ETHANE	23
C0038	43203	4.75	28.05	ETHYLENE	33
C0038	43205	17.61	42.08	PROPYLENE	43
C0038	43206	5.77	26.04	ACETYLENE	53
C0038	43231	7.49	86.18	N-HEXANE	63
C0038	43232	31.99	100.21	N-HEPTANE	73
C0038	45201	2.66	78.12	BENZENE	83
C0038	45202	10.21	92.15	TOLUENE	93
C0038	45205	3.92	106.17	1,3 DIMETHYLBENZENE	103
C0038	45207	3.46	120.19	1,3,5-TRIMETHYLBENZENE	113
C0038	45212	4.44	120.19	M-ETHYLTOLUENE	123
C0038	45232	0.28	132.00	TETRAMETHYLBENZENE	133
C0040				C0040	2
C0040	43204	1.69	44.09	PROPANE	13
C0040	43212	18.76	58.12	N-BUTANE	23
C0040	43213	1.72	56.10	BUTENE	33
C0040	43214	6.25	58.12	ISOBUTANE	43
C0040	43220	10.22	72.15	N-PENTANE	53
C0040	43224	5.98	70.14	1-PENTENE	63
C0040	43231	2.58	86.18	N-HEXANE	73
C0040	43232	0.71	100.21	N-HEPTANE	83
C0040	43233	0.17	114.23	N-OCTANE	93
C0040	43235	0.04	128.26	N-NONANE	103
C0040	43105	8.90	86.18	ISOMERS OF HEXANE	113
C0040	43106	2.22	100.21	ISOMERS OF HEPTANE	123
C0040	43238	0.15	142.29	N-DECANE	133
C0040	43107	2.31	114.23	ISOMERS OF OCTANE	143
C0040	43248	2.19	84.16	CYCLOHEXANE	153
C0040	43108	0.26	128.26	ISOMERS OF NONANE	163
C0040	43115	0.25	98.19	C-7 CYCLOPARAFFINS	173
C0040	43122	27.76	72.15	ISOMERS OF PENTANE	183
C0040	45102	2.30	106.17	ISOMERS OF XYLENE	193
C0040	45201	1.18	78.12	BENZENE	203
C0040	45202	2.55	92.15	TOLUENE	213
C0040	45103	0.25	134.22	DIMETHYL ETHEL BENZENE	223
C0040	45104	0.86	120.19	ISOMERS OF ETHYLTOLUENE	233
C0040	45105	0.10	134.22	ISOMERS OF BUTYLBENZENE	243
C0040	45107	0.59	120.19	ISOMERS OF TRIMETHYLBENZENE	253
C0040	45108	0.02	120.19	ISOMERS OF PROPYLBENZENE	263
C0043				C0043	2
C0043	43107	0.58	114.23	ISOMERS OF OCTANE	13
C0043	43108	19.82	128.25	ISOMERS OF NONANE	23
C0043	43109	50.32	142.29	ISOMERS OF DECANE	33
C0043	43110	1.89	156.32	ISOMERS OF UNDECANE	43
C0043	43617	27.40	165.83	PERCHLOROETHYLENE	53
C0044				C0044	2
C0044	43201	56.50	16.04	METHANE	13
C0044	43202	5.00	30.07	ETHANE	23
C0044	43203	2.00	28.05	ETHYLENE	33
C0044	43204	3.10	44.09	PROPANE	43
C0044	43212	23.40	58.12	N-BUTANE	53
C0045				C0045	2
C0045	43204	1.69	44.09	PROPANE	13
C0045	43212	18.76	58.12	N-BUTANE	23
C0045	43213	1.72	56.10	BUTENE	33
C0045	43214	6.25	58.12	ISOBUTANE	43
C0045	43220	10.22	72.15	N-PENTANE	53
C0045	43224	5.98	70.14	1-PENTENE	63
C0045	43231	2.58	86.18	N-HEXANE	73
C0045	43232	0.71	100.21	N-HEPTANE	83
C0045	43233	0.17	114.23	N-OCTANE	93
C0045	43235	0.04	128.26	N-NONANE	103

Table I-2 (continued)

```
C0045  43105         8.90     86.18  ISOMERS OF HEXANE                          113
C0045  43106         2.22    100.21  ISOMERS OF HEPTANE                         123
C0045  43238         0.15    142.29  N-DECANE                                   133
C0045  43107         2.31    114.23  ISOMERS OF OCTANE                          143
C0045  43248         2.19     84.16  CYCLOHEXANE                                153
C0045  43108         0.26    128.26  ISOMERS OF NONANE                          163
C0045  43115         0.25     98.19  C-7 CYCLOPARAFFINS                         173
C0045  43122        27.76     72.15  ISOMERS OF PENTANE                         183
C0045  45102         2.30    106.17  ISOMERS OF XYLENE                          193
C0045  45201         1.18     78.12  BENZENE                                    203
C0045  45202         2.55     92.15  TOLUENE                                    213
C0045  45103         0.25    134.22  DIMETHYL ETHYL BENZENE                     223
C0045  45104         0.86    120.19  ISOMERS OF ETHYLTOLUENE                    233
C0045  45105         0.10    134.22  ISOMERS OF BUTYLBENZENE                    243
C0045  45107         0.59    120.19  ISOMERS OF TRIMETHYLBENZENE                253
C0045  45108         0.02    120.19  ISOMERS OF PROPYLBENZENE                   263
C0047                               C0047                                         2
C0047  43107         0.80    114.23  ISOMERS OF OCTANE                           13
C0047  43108        27.30    128.26  ISOMERS OF NONANE                           23
C0047  43109        69.30    142.29  ISOMERS OF DECANE                           33
C0047  43110         2.60    156.32  ISOMERS OF UNDECANE                         43
C0049     95.00   5.00              C0049                                         2
C0049  43000       100.00     86.00  UNIDENTIFIED HYDROCARBONS                   13
C0051     85.00  15.00   0.01       C0051                                         2
C0051  43201        79.54     16.04  METHANE                                     13
C0051  43202         0.84     30.07  ETHANE                                      23
C0051  43203         1.80     28.05  ETHYLENE                                    33
C0051  43204         0.74     44.09  PROPANE                                     43
C0051  43205         2.61     42.08  PROPYLENE                                   53
C0051  43206         3.53     26.04  ACETYLENE                                   63
C0051  43212         1.78     58.12  N-BUTANE                                    73
C0051  43213         0.04     56.10  BUTENE                                      83
C0051  43214         0.33     58.12  ISOBUTANE                                   93
C0051  43220         0.02     72.15  N-PENTANE                                  103
C0051  43224         0.04     70.14  1-PENTENE                                  113
C0051  43231         0.09     86.18  N-HEXANE                                   123
C0051  43232         0.09    100.21  N-HEPTANE                                  133
C0051  43233         0.09    114.23  N-OCTANE                                   143
C0051  43121         0.08     70.14  ISOMERS OF PENTENE                         153
C0051  43122         0.01     72.15  ISOMERS OF PENTANE                         163
C0051  43502         0.01     30.03  FORMALDEHYDE                               173
C0051  43551         6.87     58.08  ACETONE                                    183
C0051  45201         1.49     78.12  BENZENE                                    193
C0081     94.00   6.00  01.81       C0081                                         2
C0081  43201        75.40     16.04  METHANE                                     13
C0081  43202         9.91     30.07  ETHANE                                      23
C0081  43203          .99     28.05  ETHYLENE                                    33
C0081  43204         9.91     44.09  PROPANE                                     43
C0081  43212          .99     58.12  N-BUTANE                                    53
C0061  43214          .99     58.12  ISOBUTANE                                   63
C0081  43502         1.81     30.03  FORMALDEHYDE                                73
C0085     85.00  15.00  00.06       C0085                                         2
C0085  43201        53.97     16.04  METHANE                                     13
C0085  43202         5.25     30.07  ETHANE                                      23
C0085  43203        16.00     28.05  ETHYLENE                                    33
C0085  43204          .58     44.09  PROPANE                                     34
C0085  43205         1.79     42.08  PROPYLENE                                   43
C0085  43206         1.46     26.04  ACETYLENE                                   53
C0085  43212          .07     58.12  N-BUTANE                                    63
C0085  43213          .63     56.10  BUTENE                                      73
C0085  43218          .30     54.09  1,3-BUTADIENE                               83
C0085  43220          .04     72.15  N-PENTANE                                   93
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Table I-2 (continued)

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C0085  43231          .26     86.18  N-HEXANE                           103
C0085  43232         1.33    100.21  N-HEPTANE                          113
C0085  43233          .03    114.23  N-OCTANE                           123
C0085  43235          .01    128.25  N-NONANE                           133
C0085  43105          .01     86.18  ISOMERS OF HEXANE                  143
C0085  43248          .01     84.16  CYCLOHEXANE                        153
C0085  43109          .01    128.25  ISOMERS OF NONANE                  163
C0085  43116          .02    112.23  C-8 CYCLOPARAFFINS                 173
C0085  43122          .07     72.15  ISOMERS OF PENTANE                 183
C0085  43502          .06     30.03  FORMALDEHYDE                       193
C0085  43822         2.60     93.19  TRIMETHYLFLUOROSILANE              203
C0085  45201        12.96     78.12  BENZENE                            213
C0085  45202          .57     92.15  TOLUENE                            223
C0086                    17.96     C0086                                  2
C0086  43201        36.70     16.04  METHANE                             13
C0086  43204         2.13     44.09  PROPANE                             23
C0086  43212         7.61     58.12  N-BUTANE                            33
C0086  43214         1.21     58.12  ISOBUTANE                           43
C0086  43220         4.06     72.15  N-PENTANE                           53
C0086  43231         4.97     86.18  N-HEXANE                            63
C0086  43232        12.48    100.21  N-HEPTANE                           73
C0086  43105         1.98     86.18  ISOMERS OF HEXANE                   83
C0086  43106          .77    100.21  ISOMERS OF HEPTANE                  93
C0086  43107         1.39    114.23  ISOMERS OF OCTANE                  103
C0086  43248          .44     84.16  CYCLOHEXANE                        113
C0086  43122         5.63     72.15  ISOMERS OF PENTANE                 123
C0086  43502        17.96     30.03  FORMALDEHYDE                       133
C0086  45201         1.78     78.12  BENZENE                            143
C0086  45202          .89     92.15  TOLUENE                            153
C0090                    11.29     C0090                                  2
C0090  43105         1.03     86.18  ISOMERS OF HEXANE                   13
C0090  43106          .48    100.21  ISOMERS OF HEPTANE                  23
C0090  43107          .18    114.23  ISOMERS OF OCTANE                   33
C0090  43108          .13    128.25  ISOMERS OF NONANE                   43
C0090  43129          .09    142.29  ISOMERS OF DECANE                   53
C0090  43115          .23     98.19  C-7 CYCLOPARAFFINS                  63
C0090  43116          .06    112.23  C-8 CYCLOPARAFFINS                  73
C0090  43117          .03    126.25  C-9 CYCLOPARAFFINS                  83
C0090  43122         1.40     72.15  ISOMERS OF PENTANE                  93
C0090  43201         9.05     16.04  METHANE                            103
C0090  43202        14.96     30.07  ETHANE                             113
C0090  43203          .13     28.05  ETHYLENE                           123
C0090  43204        15.29     44.09  PROPANE                            133
C0090  43205        11.90     42.08  PROPYLENE                          143
C0090  43206          .01     26.04  ACETYLENE                          153
C0090  43212        21.11     58.12  N-BUTANE                           163
C0090  43213          .06     56.10  BUTENE                             173
C0090  43214         4.73     58.12  ISOBUTANE                          183
C0090  43220         1.23     72.15  N-PENTANE                          193
C0090  43231         1.73     86.18  N-HEXANE                           203
C0090  43232          .23    100.21  N-HEPTANE                          213
C0090  43233          .48    114.23  N-OCTANE                           223
C0090  43235          .08    128.25  N-NONANE                           233
C0090  43238          .06    142.29  N-DECANE                           243
C0090  43248          .02     84.16  CYCLOHEXANE                        253
C0090  43502        11.29     30.03  FORMALDEHYDE                       263
C0090  43551         3.61     58.08  ACETONE                            273
C0090  45132          .10    106.17  ISOMERS OF XYLENE                  283
C0090  45201          .11     78.12  BENZENE                            293
C0090  45202          .18     92.15  TOLUENE                            303
C0091                    00.05     C0091                                  2
C0091  43105          .83     86.18  ISOMERS OF HEXANE                   13
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Table I-2 (continued)

C0091	43106	.39	100.21	ISOMERS OF HEPTANE	23
C0091	43107	1.08	114.23	ISOMERS OF OCTANE	33
C0091	43108	6.85	128.26	ISOMERS OF NONANE	43
C0091	43109	17.31	142.29	ISOMERS OF DECANE	53
C0091	43110	.64	156.32	ISOMERS OF UNDECANE	63
C0091	43115	.48	98.19	C-7 CYCLOPARAFFINS	73
C0091	43122	6.70	72.15	ISOMERS OF PENTANE	83
C0091	43201	1.74	16.04	METHANE	93
C0091	43202	.54	30.07	ETHANE	103
C0091	43203	.02	28.05	ETHYLENE	113
C0091	43204	1.27	44.09	PROPANE	123
C0091	43205	.01	42.08	PROPYLENE	133
C0091	43212	5.01	58.12	N-BUTANE	143
C0091	43213	.05	56.10	BUTENE	153
C0091	43214	2.02	58.12	ISOBUTANE	163
C0091	43220	3.52	72.15	N-PENTANE	173
C0091	43224	.17	70.14	1-PENTENE	183
C0091	43231	3.51	86.18	N-HEXANE	193
C0091	43232	.41	100.21	N-HEPTANE	203
C0091	43233	.18	114.23	N-OCTANE	213
C0091	43248	1.61	84.16	CYCLOHEXANE	223
C0091	43301	2.94	32.04	METHYL ALCOHOL	233
C0091	43302	3.24	46.07	ETHYL ALCOHOL	243
C0091	43304	3.38	60.09	ISOPROPYL ALCOHOL	253
C0091	43306	.30	74.12	ISOBUTYL ALCOHOL	263
C0091	43432	.04	74.08	METHYL ACETATE	273
C0091	43433	.49	88.10	ETHYL ACETATE	283
C0091	43502	.05	30.03	FORMALDEHYDE	293
C0091	43551	7.14	58.08	ACETONE	303
C0091	43552	6.68	72.10	METHYL ETHYL KETONE	313
C0091	43560	3.40	100.16	METHYL ISOBUTYL KETONE	323
C0091	43815	.05	99.00	ETHYLENE DICHLORIDE	333
C0091	43817	5.83	165.83	PERCHLOROETHYLENE	343
C0091	45104	.01	120.19	ISOMERS OF ETHYLTOLUENE	353
C0091	45201	1.67	78.12	BENZENE	363
C0091	45202	6.05	92.15	TOLUENE	373
C0091	45221	4.39	118.15	A-METHYLSTYRENE	383
C0091	45107	.01	120.19	ISOMERS OF TRIMETHYLBENZENE	393
C0094				C0094	2
C0094	43105	8.90	86.18	ISOMERS OF HEXANE	13
C0094	43106	2.00	100.21	ISOMERS OF HEPTANE	23
C0094	43107	1.90	114.23	ISOMERS OF OCTANE	33
C0094	43108	.20	128.26	ISOMERS OF NONANE	43
C0094	43115	.20	98.19	C-7 CYCLOPARAFFINS	53
C0094	43122	29.00	72.15	ISOMERS OF PENTANE	63
C0094	43204	1.80	44.09	PROPANE	73
C0094	43212	19.80	58.12	N-BUTANE	83
C0094	43213	1.80	56.10	BUTENE	93
C0094	43214	6.60	58.12	ISOBUTANE	103
C0094	43220	10.60	72.15	N-PENTANE	113
C0094	43224	6.20	70.14	1-PENTENE	123
C0094	43231	2.50	86.18	N-HEXANE	133
C0094	43232	.60	100.21	N-HEPTANE	143
C0094	43233	.10	114.23	N-OCTANE	153
C0094	43248	2.10	84.16	CYCLOHEXANE	163
C0094	45102	1.60	106.17	ISOMERS OF XYLENE	173
C0094	45103	.40	134.22	DIMETHYLETHYLBENZENE	183
C0094	45104	.50	120.19	ISOMERS OF ETHYLTOLUENE	193
C0094	45201	1.10	78.12	BENZENE	203
C0094	45202	2.10	92.15	TOLUENE	213
C0101				C0101	2
C0101	43204	1.80	44.09	PROPANE	13

Table I-2 (continued)

C0101	43212	19.80	58.12	N-BUTANE	23
C0101	43213	1.80	56.10	BUTENE	33
C0101	43214	6.60	58.12	ISOBUTANE	43
C0101	43220	10.60	72.15	N-PENTANE	53
C0101	43224	6.20	70.14	1-PENTENE	63
C0101	43231	2.50	86.18	N-HEXANE	73
C0101	43232	0.60	100.21	N-HEPTANE	83
C0101	43233	0.10	114.23	N-OCTANE	93
C0101	43105	9.90	86.18	ISOMERS OF HEXANE	103
C0101	43106	2.00	100.21	ISOMERS OF HEPTANE	113
C0101	43107	1.90	114.23	ISOMERS OF OCTANE	123
C0101	43248	2.10	84.16	CYCLOHEXANE	133
C0101	43108	0.20	128.26	ISOMERS OF NONANE	143
C0101	43115	0.20	98.19	C-7 CYCLOPARAFFINS	153
C0101	43122	29.00	72.15	ISOMERS OF PENTANE	163
C0101	45102	1.60	106.17	ISOMERS OF XYLENE	173
C0101	45201	1.10	78.12	BENZENE	183
C0101	45202	2.10	92.15	TOLUENE	193
C0101	45103	0.10	134.22	DIMETHYL ETHEL BENZENE	203
C0101	45104	0.50	120.19	ISOMERS OF ETHYLTOLUENE	213
C0101	45107	0.30	120.19	ISOMERS OF TRIMETHYLBENZENE	223
C0103				C0103	2
C0103	43201	2.54	16.04	METHANE	13
C0103	43202	0.63	30.07	ETHANE	23
C0103	43204	3.04	44.09	PROPANE	33
C0103	43212	8.52	58.12	N-BUTANE	43
C0103	43214	4.09	58.12	ISOBUTANE	53
C0103	43220	6.47	72.15	N-PENTANE	63
C0103	43231	3.74	86.18	N-HEXANE	73
C0103	43232	0.95	100.21	N-HEPTANE	83
C0103	43233	0.64	114.23	N-OCTANE	93
C0103	43105	1.90	86.18	ISOMERS OF HEXANE	103
C0103	43106	1.27	100.21	ISOMERS OF HEPTANE	113
C0103	43107	2.13	114.23	ISOMERS OF OCTANE	123
C0103	43248	0.63	84.16	CYCLOHEXANE	133
C0103	43108	6.62	128.25	ISOMERS OF NONANE	143
C0103	43109	16.06	142.29	ISOMERS OF DECANE	153
C0103	43110	0.58	156.32	ISOMERS OF UNDECANE	163
C0103	43122	5.59	72.15	ISOMERS OF PENTANE	173
C0103	43301	3.24	32.04	METHYL ALCOHOL	183
C0103	43302	3.24	46.07	ETHYL ALCOHOL	193
C0103	43304	3.29	60.09	ISOPROPYL ALCOHOL	203
C0103	43551	5.78	58.08	ACETONE	213
C0103	43552	5.78	72.10	METHYL ETHYL KETONE	223
C0103	43560	2.98	100.16	METHYL ISOBUTYL KETONE	233
C0103	43817	5.78	165.83	PERCHLOROETHYLENE	243
C0103	45102	2.31	106.17	ISOMERS OF XYLENE	253
C0103	45202	2.31	92.15	TOLUENE	263
C0110				C0110	2
C0110	43231	20.70	86.18	N-HEXANE	13
C0110	43248	20.70	84.16	CYCLOHEXANE	23
C0110	43301	3.90	32.04	METHYL ALCOHOL	33
C0110	43302	.60	46.07	ETHYL ALCOHOL	43
C0110	43304	16.40	60.09	ISOPROPYL ALCOHOL	53
C0110	43305	1.60	74.12	N-BUTYL ALCOHOL	63
C0110	43306	.60	74.12	ISOBUTYL ALCOHOL	73
C0110	43369	.80	76.00	PROPYLENE GLYCOL	83
C0110	43370	.60	62.07	ETHYLENE GLYCOL	93
C0110	43435	2.50	116.16	N-BUTYL ACETATE	103
C0110	43443	1.30	90.00	CELLOSOLVE ACETATE	113
C0110	43446	1.50	116.16	ISOBUTYL ACETATE	123
C0110	43450	.50	73.09	DIMETHYLFORMAMIDE	133

Table I-2 (continued)

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C0110  43451      6.10    144.21  ISOBUTYL ISOBUTYRATE           143
C0110  43551      3.20     58.08  ACETONE                        153
C0110  43552      5.60     72.10  METHYL ETHYL KETONE            163
C0110  43559       .70    100.16  METHYL N-BUTYL KETONE          173
C0110  43560       .60    100.16  METHYL ISOBUTYL KETONE         183
C0110  45102      2.60    106.17  ISOMERS OF XYLENE              193
C0110  45202      5.20     92.15  TOLUENE                        203
C0110  45203      4.30    106.17  ETHYLBENZENE                   213
C0111                             C0111                            2
C0111  43231       .70     86.18  N-HEXANE                        13
C0111  43248     20.70     84.16  CYCLOHEXANE                     23
C0111  43301      3.90     32.04  METHYL ALCOHOL                  33
C0111  43302       .60     46.07  ETHYL ALCOHOL                   43
C0111  43304     16.40     60.09  ISOPROPYL ALCOHOL               53
C0111  43305      1.60     74.12  N-BUTYL ALCOHOL                 63
C0111  43306       .60     74.12  ISOBUTYL ALCOHOL                73
C0111  43369       .80     76.00  PROPYLENE GLYCOL                83
C0111  43370       .60     62.07  ETHYLENE GLYCOL                 93
C0111  43435      2.50    116.16  N-BUTYL ACETATE                103
C0111  43443      1.30     90.00  CELLOSOVE ACETATE              113
C0111  43446      1.50    116.16  ISOBUTYL ACETATE               123
C0111  43450       .50     73.09  DIMETHYLFORMAMIDE              133
C0111  43451      6.10    144.21  ISOBUTYLISOBUTYRATE            143
C0111  43551      3.20     58.08  ACETONE                        153
C0111  43552      5.60     72.10  METHYL ETHYL KETONE            163
C0111  43559       .70    100.16  METHYL N-BUTYL KETONE          173
C0111  43560       .60    100.16  METHYL ISOBUTYL KETONE         183
C0111  45102      2.60    106.17  ISOMERS OF XYLENE              193
C0111  45202      5.20     92.15  TOLUENE                        203
C0111  45203      4.30    106.17  ETHYLBENZENE                   213
C0113                    09.17   C0113                             2
C0113  43201     38.66     16.04  METHANE                         13
C0113  43202      8.20     30.07  ETHANE                          23
C0113  43203      1.24     28.05  ETHYLENE                        33
C0113  43204      2.67     44.09  PROPANE                         43
C0113  43205     14.27     42.08  PROPYLENE                       53
C0113  43212      8.45     58.12  N-BUTANE                        63
C0113  43213      5.77     56.10  BUTENE                          73
C0113  43214      1.37     58.12  ISOBUTANE                       83
C0113  43224      5.01     70.14  1-PENTENE                       93
C0113  43304       .11     60.09  ISOPROPYL ALCOHOL              103
C0113  43502      9.17     30.03  FORMALDEHYDE                   113
C0113  43802      4.89     84.94  DICHLOROMETHANE                123
C0116    85.00  15.00             C0116                            2
C0116  43201     70.00     16.04  METHANE                         13
C0116  43202     20.00     30.07  ETHANE                          23
C0116  43302      2.00     46.07  ETHYL ALCOHOL                   33
C0116  43304      2.00     60.09  ISOPROPYL ALCOHOL               43
C0116  43434      2.00    102.13  PROPYL ACETATE                  53
C0116  43551      2.00     58.08  ACETONE                         63
C0116  43721      1.00     45.09  ETHYLAMINE                      73
C0116  43740      1.00     59.11  TRIMETHYLAMINE                  83
C0120    97.00   3.00  00.12      C0120                            2
C0120  43201     11.00     16.04  METHANE                         13
C0120  43212     14.00     58.12  N-BUTANE                        23
C0120  43231      5.00     86.18  N-HEXANE                        33
C0120  43502       .12     30.03  FORMALDEHYDE                    43
C0120  43551     28.00     58.08  ACETONE                         53
C0121    95.00   5.00             C0121                            2
C0121  43201      4.22     16.04  METHANE                         13
C0121  43202      3.16     30.07  ETHANE                          23
C0121  43203      4.75     28.05  ETHYLENE                        33
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Table I-2 (continued)

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C0121  43205        17.61      42.08  PROPYLENE                                    43
C0121  43206         5.77      26.04  ACETYLENE                                    53
C0121  43231         7.49      86.18  N-HEXANE                                     63
C0121  43232        31.99     100.21  N-HEPTANE                                    73
C0121  45201         2.66      78.12  BENZENE                                      83
C0121  45202        10.21      92.15  TOLUENE                                      93
C0121  45205         3.92     106.17  1,3 DIMETHYLBENZENE                         103
C0121  45207         3.48     120.19  1,3,5-TRIMETHYLBENZENE                      113
C0121  45212         4.44     120.19  M-ETHYLTOLUENE                              123
C0121  45232         0.28     132.00  TETRAMETHYLBENZENE                          133
K0001      98.00   2.00  42.00      101004                                          2
K0001  43212        14.00      58.12  N-BUTANE                                     13
K0001  43231         5.00      86.18  N-HEXANE                                     23
K0001  43502        42.00      30.03  FORMALDEHYDE                                 33
K0001  43551        28.00      58.08  ACETONE                                      43
K0001  43201        11.00      16.04  METHANE                                      53
K0002      98.00   2.00  48.70      101005                                          2
K0002  43105         5.20      86.18  ISOMERS OF HEXANE                            13
K0002  43106         2.60     100.21  ISOMERS OF HEPTANE                           23
K0002  43107         4.70     114.23  ISOMERS OF OCTANE                            33
K0002  43122         5.50      72.15  ISOMERS OF PENTANE                           43
K0002  43204         1.20      44.09  PROPANE                                      53
K0002  43212        12.20      58.12  N-BUTANE                                     63
K0002  43214         4.10      58.12  ISOBUTANE                                    73
K0002  43220         4.70      72.15  N-PENTANE                                    83
K0002  43231        10.80      86.18  N-HEXANE                                     93
K0002  43232          .30     100.21  N-HEPTANE                                   103
K0002  43502        48.70      30.03  FORMALDEHYDE                                113
K0003      95.00   5.00   8.00      101006                                          2
K0003  43105         1.00      86.18  ISOMERS OF HEXANE                            13
K0003  43122         9.00      72.15  ISOMERS OF PENTANE                           23
K0003  43204         4.00      44.09  PROPANE                                      33
K0003  43212         9.00      58.12  N-BUTANE                                     43
K0003  43220         6.00      72.15  N-PENTANE                                    53
K0003  43248         1.00      84.16  CYCLOHEXANE                                  63
K0003  45202         2.00      92.15  TOLUENE                                      73
K0003  43502         8.00      30.03  FORMALDEHYDE                                 83
K0003  43201        56.00      16.04  METHANE                                      93
K0003  45201         4.00      78.12  BENZENE                                     103
K0004      95.00   5.00   7.60      101007                                          2
K0004  43204        18.90      44.09  PROPANE                                      13
K0004  43212        23.10      58.12  N-BUTANE                                     23
K0004  43214         4.40      58.12  ISOBUTANE                                    33
K0004  43205        17.50      42.08  PROPYLENE                                    43
K0004  43502         7.60      30.03  FORMALDEHYDE                                 53
K0004  43201         7.60      16.04  METHANE                                      63
K0004  43202        20.90      30.07  ETHANE                                       73
K0005      97.00   3.00             102008                                          2
K0005  43203        11.70      28.05  ETHYLENE                                     13
K0005  43205          .30      42.08  PROPYLENE                                    23
K0005  43206          .80      26.04  ACETYLENE                                    33
K0005  43201        82.80      16.04  METHANE                                      43
K0005  43202         2.50      30.07  ETHANE                                       53
K0005  45201         1.90      78.12  BENZENE                                      63
K0007      94.00   6.00  30.00      201002                                          2
K0007  43502        30.00      30.03  FORMALDEHYDE                                 13
K0007  43201        70.00      16.04  METHANE                                      23
K0008      95.00   5.00  00.00      201003                                          2
K0008  43201        11.60      16.04  METHANE                                      13
K0008  43202         2.80      30.07  ETHANE                                       23
K0008  43203        28.70      28.05  ETHYLENE                                     33
K0008  43205        17.30      42.08  PROPYLENE                                    43
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Table I-2 (continued)

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K0008  43206           11.30       26.04  ACETYLENE                                    53
K0008  43213           13.40       56.10  BUTENE                                       63
K0008  43218            7.00       54.09  1,3 BUTADIENE                                73
K0008  45201            7.90       78.12  BENZENE                                      83
K0009      90.00   10.00              202001                                            2
K0009  43203           28.70       28.05  ETHYLENE                                     13
K0009  43205           17.30       42.08  PROPYLENE                                    23
K0009  43213           13.40       56.10  BUTENE                                       33
K0009  43218            7.00       54.09  1,3-BUTADIENE                                43
K0009  43206           11.30       26.04  ACETYLENE                                    53
K0009  43201           11.60       16.04  METHANE                                      63
K0009  43202            2.80       30.07  ETHANE                                       73
K0009  45201            7.90       78.12  BENZENE                                      83
K0010      94.00    6.00  01.00     202002A                                             2
K0010  43204           10.00       44.09  PROPANE                                      13
K0010  43212            1.00       58.12  N-BUTANE                                     23
K0010  43214            1.00       58.12  ISOBUTANE                                    33
K0010  43203            1.00       28.05  ETHYLENE                                     43
K0010  43502            1.00       30.03  FORMALDEHYDE                                 53
K0010  43201           76.00       16.04  METHANE                                      63
K0010  43202           10.00       30.07  ETHANE                                       73
K0011      95.00    5.00  00.00     303003                                              2
K0011  43204             .50       44.09  PROPANE                                      13
K0011  43203           27.70       28.05  ETHYLENE                                     23
K0011  43205            1.90       42.08  PROPYLENE                                    33
K0011  43213             .10       56.10  BUTENE                                       43
K0011  43218             .50       54.09  1,3-BUTADIENE                                53
K0011  45202             .70       92.15  TOLUENE                                      63
K0011  43206            1.20       26.04  ACETYLENE                                    73
K0011  43201           45.30       16.04  METHANE                                      83
K0011  43202            8.00       30.07  ETHANE                                       93
K0011  45201           14.10       78.12  BENZENE                                     103
K0012      95.00    5.00  00.00     303008A                                             2
K0012  43822           84.20       93.19  TRIMETHYLFLUOROSILANE                        13
K0012  43201           15.80       16.04  METHANE                                      23
K0013      95.00    5.00                303008B                                         2
K0013  43203            5.90       28.05  ETHYLENE                                     13
K0013  43205            3.00       42.08  PROPYLENE                                    23
K0013  43206           14.80       26.04  ACETYLENE                                    33
K0013  43201           73.30       16.04  METHANE                                      43
K0013  43202            3.00       30.07  ETHANE                                       53
K0016      95.00    5.00                303009C                                         2
K0016  43204           39.90       44.09  PROPANE                                      13
K0016  43822           49.00       93.19  TRIMETHYLFLUOROSILANE                        23
K0016  43201           11.10       16.04  METHANE                                      33
K0021      00.00   00.00  02.50     305001A                                             2
K0021  43105            1.80       86.18  ISOMERS OF HEXANE                            13
K0021  43106            3.60      100.21  ISOMERS OF HEPTANE                           23
K0021  43231            1.80       86.18  N-HEXANE                                     33
K0021  43232           15.80      100.21  N-HEPTANE                                    43
K0021  43233           74.50      114.23  N-OCTANE                                     53
K0021  43502            2.50       30.03  FORMALDEHYDE                                 63
K0022      00.00   00.00  00.00     305001B                                             2
K0022  43105           12.00       86.18  ISOMERS OF HEXANE                            13
K0022  43106           11.00      100.21  ISOMERS OF HEPTANE                           23
K0022  43107            1.00      114.23  ISOMERS OF OCTANE                            33
K0022  43204           13.00       44.09  PROPANE                                      43
K0022  43212           18.00       58.12  N-BUTANE                                     53
K0022  43214            8.00       58.12  ISOBUTANE                                    63
K0022  43220           18.00       72.15  N-PENTANE                                    73
K0022  43231            2.00       86.18  N-HEXANE                                     83
K0022  43232           14.00      100.21  N-HEPTANE                                    93
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Table I-2 (continued)

```
K0022  43203        2.00      28.05  ETHYLENE                                  103
K0022  43202        1.00      30.07  ETHANE                                    113
K0024      90.00  10.00  00.00     305001D                                       2
K0024  43105        3.40      86.18  ISOMERS OF HEXANE                          13
K0024  43107        7.40     114.23  ISOMERS OF OCTANE                          23
K0024  43115        2.90      98.19  C-7 CYCLOPARAFFINS                         33
K0024  43116         .40     112.23  C-8 CYCLOPARAFFINS                         43
K0024  43117        1.50     126.26  C-9 CYCLOPARAFFINS                         53
K0024  43122        1.10      72.15  ISOMERS OF PENTANE                         63
K0024  43204       10.20      44.09  PROPANE                                    73
K0024  43212       11.60      58.12  N-BUTANE                                   83
K0024  43214         .70      58.12  ISOBUTANE                                  93
K0024  43220        6.30      72.15  N-PENTANE                                 103
K0024  43231        4.90      86.18  N-HEXANE                                  113
K0024  43232        2.00     100.21  N-HEPTANE                                 123
K0024  43233        2.70     114.23  N-OCTANE                                  133
K0024  43242        2.50      70.14  CYCLOPENTANE                              143
K0024  43121         .50      70.14  ISOMERS OF PENTENE                        153
K0024  43203         .30      28.05  ETHYLENE                                  163
K0024  43205        2.00      42.08  PROPYLENE                                 173
K0024  43213        7.00      56.10  BUTENE                                    183
K0024  43224        3.20      70.14  1-PENTENE                                 193
K0024  45202        1.90      92.13  TOLUENE                                   203
K0024  43201       21.30      16.04  METHANE                                   213
K0024  43202        5.40      30.07  ETHANE                                    223
K0024  45201         .80      78.12  BENZENE                                   233
K0025      95.00   5.00   8.00     305002A                                       2
K0025  43105        1.00      86.18  ISOMERS OF HEXANE                          13
K0025  43122        9.00      72.15  ISOMERS OF PENTANE                         23
K0025  43204        4.00      44.09  PROPANE                                    33
K0025  43212        9.00      58.12  N-BUTANE                                   43
K0025  43220        6.00      72.15  N-PENTANE                                  53
K0025  43248        1.00      84.16  CYCLOHEXANE                                63
K0025  45202        2.00      92.15  TOLUENE                                    73
K0025  43502        8.00      30.03  FORMALDEHYDE                               83
K0025  43201       56.00      16.04  METHANE                                    93
K0025  45201        4.00      78.12  BENZENE                                   103
K0026      95.00   5.00            305002B                                       2
K0026  43105        8.10      86.18  ISOMERS OF HEXANE                          13
K0026  43115        3.70      98.19  C-7 CYCLOPARAFFINS                         23
K0026  43122        5.70      72.15  ISOMERS OF PENTANE                         33
K0026  43204        5.50      44.09  PROPANE                                    43
K0026  43212       10.10      58.12  N-BUTANE                                   53
K0026  43214       11.20      58.12  ISOBUTANE                                  63
K0026  43220        5.30      72.15  N-PENTANE                                  73
K0026  43203        2.00      28.05  ETHYLENE                                   93
K0026  43205        3.90      42.08  PROPYLENE                                 103
K0026  43213        5.90      56.10  BUTENE                                    113
K0026  43201       15.70      16.04  METHANE                                   123
K0026  43202        4.60      30.07  ETHANE                                    133
K0026  45201        9.50      78.12  BENZENE                                   143
K0029      85.00  15.00  51.00     306002                                        2
K0029  43105       13.00      86.18  ISOMERS OF HEXANE                          13
K0029  43502       51.00      30.03  FORMALDEHYDE                               23
K0029  43201       36.00      16.04  METHANE                                    33
K0031      00.00  00.00  00.00     306005                                        2
K0031  43105       12.20      86.18  ISOMERS OF HEXANE                          13
K0031  43115       16.90      98.19  C-7 CYCLOPARAFFINS                         23
K0031  43116        5.20     112.23  C-8 CYCLOPARAFFINS                         33
K0031  43122       10.10      72.15  ISOMERS OF PENTANE                         43
K0031  43204        5.90      44.09  PROPANE                                    53
K0031  43212       14.30      58.12  N-BUTANE                                   63
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Table I-2 (continued)

```
K0031  43214        4.50      58.12  ISOBUTANE                          73
K0031  43220       12.00      72.15  N-PENTANE                          83
K0031  43231       11.90      86.18  N-HEXANE                           93
K0031  43201        2.90      16.04  METHANE                           103
K0031  43202        1.70      30.07  ETHANE                            113
K0031  45201        2.40      78.12  BENZENE                           123
K0035     00.00  00.00  00.00     306007                                 2
K0035  43122      100.00      72.15  ISOMERS OF PENTANE                 13
K0038                            306008X                                 2
K0038  43105        5.50      86.18  ISOMERS OF HEXANE                  13
K0038  43106        4.10     100.21  ISOMERS OF HEPTANE                 23
K0038  43107        2.80     114.23  ISOMERS OF OCTANE                  33
K0038  43108        3.10     128.26  ISOMERS OF NONANE                  43
K0038  43109        1.90     142.29  ISOMERS OF DECANE                  53
K0038  43115        1.10      98.19  C-7 CYCLOPARAFFINS                 63
K0038  43116         .10     112.23  C-8 CYCLOPARAFFINS                 73
K0038  43117         .80     126.26  C-9 CYCLOPARAFFINS                 83
K0038  43122        6.60      72.15  ISOMERS OF PENTANE                 93
K0038  43204        3.70      44.09  PROPANE                           103
K0038  43212        7.90      58.12  N-BUTANE                          113
K0038  43214         .80      58.12  ISOBUTANE                         123
K0038  43220       11.10      72.15  N-PENTANE                         133
K0038  43231       11.00      86.18  N-HEXANE                          143
K0038  43232        8.50     100.21  N-HEPTANE                         153
K0038  43233       12.00     114.23  N-OCTANE                          163
K0038  43235        3.90     128.26  N-NONANE                          173
K0038  43238        5.10     142.29  N-DECANE                          183
K0038  43248         .50      84.16  CYCLOHEXANE                       193
K0038  43213         .20      56.10  BUTENE                            203
K0038  45102        1.30     106.17  ISOMERS OF XYLENE                 213
K0038  45202        3.00      92.13  TOLUENE                           223
K0038  43201        3.30      16.04  METHANE                           233
K0038  43202        1.20      30.07  ETHANE                            243
K0038  45201         .50      78.12  BENZENE                           253
K0039     00.00  00.00  00.00     306008Z                                2
K0039  43105        1.00      86.18  ISOMERS OF HEXANE                  13
K0039  43106         .10     100.21  ISOMERS OF HEPTANE                 23
K0039  43122        8.60      72.15  ISOMERS OF PENTANE                 33
K0039  43204       16.00      44.09  PROPANE                            43
K0039  43212       23.20      58.12  N-BUTANE                           53
K0039  43214       10.00      58.12  ISOBUTANE                          63
K0039  43220        7.60      72.15  N-PENTANE                          73
K0039  43231        4.60      86.18  N-HEXANE                           83
K0039  43205        8.80      42.08  PROPYLENE                          93
K0039  43213        1.20      56.10  BUTENE                            103
K0039  43201       13.30      16.04  METHANE                           113
K0039  43202        5.60      30.07  ETHANE                            123
K0047     00.00  00.00  00.00     306038N                                2
K0047  43204       90.40      44.09  PROPANE                            13
K0047  43214         .40      58.12  ISOBUTANE                          23
K0047  43205        5.10      42.08  PROPYLENE                          33
K0047  43202        4.10      30.07  ETHANE                             43
K0051     95.00   5.00  20.00     306089                                 2
K0051  43204       30.00      44.09  PROPANE                            13
K0051  43502       20.00      30.03  FORMALDEHYDE                       23
K0051  43201       20.00      16.04  METHANE                            33
K0051  43202       30.00      30.07  ETHANE                             43
K0053                   00.00     306013                                 2
K0053  43105         .80      86.19  ISOMERS OF HEXANE                  13
K0053  43107         .70     114.23  ISOMERS OF OCTANE                  23
K0053  43108        2.50     128.26  ISOMERS OF NONANE                  33
K0053  43109        2.00     142.29  ISOMERS OF DECANE                  43
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Table I-2 (continued)

K0053	43115	.30	98.19	C-7 CYCLOPARAFFINS	53
K0053	43117	.60	126.26	C-9 CYCLOPARAFFINS	63
K0053	43122	.90	72.15	ISOMERS OF PENTANE	73
K0053	43204	26.70	44.09	PROPANE	83
K0053	43212	22.60	58.12	N-BUTANE	93
K0053	43214	20.70	58.12	ISOBUTANE	103
K0053	43220	.20	72.15	N-PENTANE	113
K0053	43231	.80	86.18	N-HEXANE	123
K0053	43232	.20	100.21	N-HEPTANE	133
K0053	43233	.80	114.23	N-OCTANE	143
K0053	43235	1.00	128.26	N-NONANE	153
K0053	43248	.20	84.16	CYCLOHEXANE	163
K0053	45102	.80	106.17	ISOMERS OF XYLENE	173
K0053	45202	.80	92.15	TOLUENE	183
K0053	43201	.90	16.04	METHANE	193
K0053	43202	16.20	30.07	ETHANE	203
K0053	45201	.30	78.12	BENZENE	213
K0056	90.00	10.00		402008C	2
K0056	43106	.70	100.21	ISOMERS OF HEPTANE	13
K0056	43107	.60	114.23	ISOMERS OF OCTANE	23
K0056	43108	10.10	128.26	ISOMERS OF NONANE	33
K0056	43115	1.40	98.19	C-7 CYCLOPARAFFINS	43
K0056	43116	25.60	112.23	C-8 CYCLOPARAFFINS	53
K0056	43117	5.00	126.26	C-9 CYCLOPARAFFINS	63
K0056	43231	.20	86.18	N-HEXANE	73
K0056	43232	1.40	100.21	N-HEPTANE	83
K0056	43233	46.50	114.23	N-OCTANE	93
K0056	43235	7.30	128.26	N-NONANE	103
K0056	45102	1.00	106.17	ISOMERS OF XYLENE	113
K0056	45202	.20	92.15	TOLUENE	123
K0060	00.00	00.00	00.00	330001	2
K0060	43551	20.00	58.08	ACETONE	13
K0060	43552	21.40	72.10	METHYL ETHYL KETONE	23
K0060	43560	8.60	100.16	METHYL ISOBUTYL KETONE	33
K0060	43301	5.60	32.04	METHYL ALCOHOL	43
K0060	43302	4.50	46.07	ETHYL ALCOHOL	53
K0060	43304	16.40	60.09	ISOPROPYL ALCOHOL	63
K0060	43305	23.50	74.12	N-BUTYL ALCOHOL	73
K0066	00.00	00.00	00.00	301015	2
K0066	43551	38.70	58.08	ACETONE	13
K0066	43552	41.60	72.10	METHYL ETHYL KETONE	23
K0066	43560	16.70	100.16	METHYL ISOBUTYL KETONE	33
K0066	43367	3.00	62.07	GLYCOL ETHER	43
K0067	00.00	00.00	00.00	301018A	2
K0067	43660	100.00	62.50	VINYL CHLORIDE	13
K0068	00.00	00.00	00.00	301018B	2
K0068	43205	100.00	42.08	PROPYLENE	13
K0071				301019A	2
K0071	43122	22.60	72.15	ISOMERS OF PENTANE	13
K0071	43204	10.80	44.09	PROPANE	23
K0071	43212	33.90	58.12	N-BUTANE	33
K0071	43231	21.40	86.18	N-HEXANE	43
K0071	43248	11.30	84.16	CYCLOHEXANE	53
K0072	00.00	00.00	00.00	301020	2
K0072	43118	25.50	114.00	MINERAL SPIRITS	13
K0072	43248	5.00	84.16	CYCLOHEXANE	23
K0072	45106	3.50	134.21	ISOMERS OF DIETHYLBENZENE	33
K0072	45203	3.00	106.17	ETHYLBENZENE	43
K0072	43551	5.50	58.08	ACETONE	53
K0072	43552	5.00	72.10	METHYL ETHYL KETONE	63
K0072	43301	5.00	32.04	METHYL ALCOHOL	73
K0072	43302	2.50	46.07	ETHYL ALCOHOL	83

Table I-2 (continued)

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K0072  43304       38.00      60.09  ISOPROPYL ALCOHOL                 93
K0072  43305        3.00      74.12  N-BUTYL ALCOHOL                  103
K0072  43435        4.00     116.16  N-BUTYL ACETATE                  113
K0076                     00.00      935705                             2
K0076  43105        8.10      86.18  ISOMERS OF HEXANE                 13
K0076  43115       15.40      98.19  C-7 CYCLOPARAFFINS                23
K0076  43116        1.60     112.23  C-8 CYCLOPARAFFINS                33
K0076  43118       15.00     114.00  MINERAL SPIRITS                   43
K0076  43122        3.10      72.15  ISOMERS OF PENTANE                53
K0076  43204        1.60      44.09  PROPANE                           63
K0076  43212        4.40      58.12  N-BUTANE                          73
K0076  43214        1.40      58.12  ISOBUTANE                         83
K0076  43220        3.20      72.15  N-PENTANE                         93
K0076  43231        3.70      86.18  N-HEXANE                         103
K0076  45102       15.00     106.17  ISOMERS OF XYLENE                113
K0076  45202        5.00      92.15  TOLUENE                          123
K0076  43619       10.00     173.85  METHYLENE BROMIDE                133
K0076  45201       12.30      78.12  BENZENE                          143
K0078     00.00  00.00  00.00      301125                               2
K0078  43615      100.00      99.00  ETHYLENE DICHLORIDE               13
K0079     95.00   5.00   1.70      301999                               2
K0079  43248        1.80      84.16  CYCLOHEXANE                       13
K0079  43120        8.90      56.10  ISOMERS OF BUTENE                 23
K0079  43203       21.60      28.05  ETHYLENE                          33
K0079  43205        9.00      42.08  PROPYLENE                         43
K0079  43213        4.10      56.10  BUTENE                            53
K0079  45102        1.30     106.17  ISOMERS OF XYLENE                 63
K0079  45202        4.10      92.15  TOLUENE                           73
K0079  45220        3.40     104.15  STYRENE                           83
K0079  43502        1.70      30.03  FORMALDEHYDE                      93
K0079  43503         .70      44.05  ACETALDEHYDE                     103
K0079  43510         .80      72.12  BUTYRALDEHYDE                    113
K0079  43206        1.00      26.04  ACETYLENE                        123
K0079  43301        5.40      32.04  METHYL ALCOHOL                   133
K0079  43302        1.40      46.07  ETHYL ALCOHOL                    143
K0079  43304        2.50      60.09  ISOPROPYL ALCOHOL                153
K0079  43305         .50      74.12  N-BUTYL ALCOHOL                  163
K0079  43438         .80     100.11  ETHYL ACRYLATE                   173
K0079  43601        4.60      44.05  ETHYLENE  OXIDE                  183
K0079  43602        1.40      58.08  PROPYLENE OXIDE                  193
K0079  43704        3.00      55.06  ACRYLONITRILE                    203
K0079  43812        7.20      64.52  ETHYL CHLORIDE                   213
K0079  43860         .60      62.50  VINYL CHLORIDE                   223
K0079  45300        2.00      94.11  PHENOLS                          233
K0079  45401        1.30     230.00  XYLENE BASE ACIDS                243
K0079  43801         .90      50.49  METHYL CHLORIDE                  253
K0079  45201       10.00      78.12  BENZENE                          263
K0085     00.00  00.00  00.00      401001C                              2
K0085  43817      100.00     165.83  PERCHLOROETHYLENE                 13
K0086     00.00  00.00  00.00      401001B                              2
K0086  43107         .80     114.23  ISOMERS OF OCTANE                 13
K0086  43108       27.30     128.26  ISOMERS OF NONANE                 23
K0086  43109       69.30     142.29  ISOMERS OF DECANE                 33
K0086  43110        2.60     156.32  ISOMERS OF UNDECANE               43
K0087     00.00  00.00  00.00      401001A                              2
K0087  43614      100.00     133.42  1,1,1,-TRICHLOROETHANE            13
K0088                              401002E                              2
K0088  43611      100.00     137.37  TRICHLOROFLUOROMETHANE            13
K0089     00.00  00.00  00.00      401002A                              2
K0089  43820      100.00     133.42  1,1,2-TRICHLOROETHANE             13
K0090     00.00  00.00  00.00      401002D                              2
K0090  45202      100.00      92.15  TOLUENE                           13
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Table I-2 (continued)

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K0092     90.00  10.00  00.00     402008A                                        2
K0092  43204        3.10      44.09  PROPANE                                    13
K0092  43212       23.40      58.12  N-BUTANE                                   23
K0092  43203        2.00      28.05  ETHYLENE                                   33
K0092  43201       66.50      16.04  METHANE                                    43
K0092  43202        5.00      30.07  ETHANE                                     53
K0096     00.00  00.00  00.00     402009A                                        2
K0096  43107         .40     114.23  ISOMERS OF OCTANE                          13
K0096  43108       10.90     128.26  ISOMERS OF NONANE                          23
K0096  43109       27.80     142.29  ISOMERS OF DECANE                          33
K0096  43110        1.00     156.32  ISOMERS OF UNDECANE                        43
K0096  45102        4.00     106.17  ISOMERS OF XYLENE                          53
K0096  45202        4.00      52.15  TOLUENE                                    63
K0096  43551       10.00      58.08  ACETONE                                    73
K0096  43552       10.00      72.10  METHYL ETHYL KETONE                        83
K0096  43560        5.00     100.16  METHYL ISOBUTYL KETONE                     93
K0096  43301        5.60      32.04  METHYL ALCOHOL                            103
K0096  43302        5.60      46.07  ETHYL ALCOHOL                             113
K0096  43304        5.70      60.09  ISOPROPYL ALCOHOL                         123
K0096  43817       10.00     165.83  PERCHLOROETHYLENE                         133
K0098                             403001A                                        2
K0098  43204         .10      44.09  PROPANE                                    13
K0098  43212        2.20      58.12  N-BUTANE                                   23
K0098  43214         .50      58.12  ISOBUTANE                                  33
K0098  43220       12.20      72.15  N-PENTANE                                  43
K0098  43231       16.30      86.18  N-HEXANE                                   53
K0098  43232        9.30     100.21  N-HEPTANE                                  63
K0098  43233       10.10     114.23  N-OCTANE                                   73
K0098  43235        1.80     128.26  N-NONANE                                   83
K0098  43238        2.60     142.29  N-DECANE                                   93
K0098  43213         .40      56.10  BUTENE                                    103
K0098  43224        2.50      70.14  1-PENTENE                                 113
K0098  45102       13.50     106.17  ISOMERS OF XYLENE                         123
K0098  45104        6.50     120.19  ISOMERS OF ETHYLTOLUENE                   133
K0098  45105        4.40     134.22  ISOMERS OF BUTYLBENZENE                   143
K0098  45107        5.50     120.19  ISOMERS OF TRIMETHYLBENZENE               153
K0098  45202        9.70      92.15  TOLUENE                                   163
K0098  45201        2.40      78.12  BENZENE                                   173
K0100                     00.00   403001E                                        2
K0100  43232         .10     100.21  N-HEPTANE                                  13
K0100  43233         .50     114.23  N-OCTANE                                   23
K0100  43235        4.70     128.25  N-NONANE                                   33
K0100  43238       19.60     142.29  N-DECANE                                   43
K0100  43241       20.30     156.32  N-UNDECANE                                 53
K0100  43255       15.20     170.34  N-DODECANE                                 63
K0100  43258       17.70     184.37  N-TRIDECANE                                73
K0100  43259       11.70     198.40  N-TETRADECANE                              83
K0100  43260        7.20     212.42  N-PENTADECANE                              93
K0121     85.00  15.00               501002                                      2
K0121  43204        1.90      44.09  PROPANE                                    13
K0121  43212        1.90      58.12  N-BUTANE                                   23
K0121  43214        1.90      58.12  ISOBUTANE                                  33
K0121  43220        1.90      72.15  N-PENTANE                                  43
K0121  43231       13.90      86.18  N-HEXANE                                   53
K0121  43232       13.90     100.21  N-HEPTANE                                  63
K0121  43233       13.80     114.23  N-OCTANE                                   73
K0121  43121       11.80      70.14  ISOMERS OF PENTENE                         83
K0121  43203       19.40      28.05  ETHYLENE                                   93
K0121  43213        5.90      56.10  BUTENE                                    103
K0121  43224       11.80      70.14  1-PENTENE                                 113
K0121  43206        1.90      26.04  ACETYLENE                                 123
K0122     85.00  15.00               501005                                      2
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Table I-2 (continued)

```
K0122  43203        8.70      28.05  ETHYLENE                               13
K0122  43205         .50      42.08  PROPYLENE                              23
K0122  43201       80.40      16.04  METHANE                                33
K0122  43202        2.70      30.07  ETHANE                                 43
K0122  45201        7.70      78.12  BENZENE                                53
K0125     00.00  00.00  00.00    402001A                                     2
K0125  45102       22.30     106.17  ISOMERS OF XYLENE                      13
K0125  45202       35.10      92.15  TOLUENE                                23
K0125  43551       12.20      58.08  ACETONE                                33
K0125  43552       10.40      72.10  METHYL ETHYL KETONE                    43
K0127     00.00  00.00  00.00    402003A                                     2
K0127  43551       38.70      58.08  ACETONE                                13
K0127  43552       41.60      72.10  METHYL ETHYL KETONE                    23
K0127  43560       16.70     100.16  METHYL ISOBUTYL KETONE                 33
K0127  43367        3.00      62.07  GLYCOL ETHER                           43
K0134                            402006A                                     2
K0134  43118       41.00     114.00  MINERAL SPIRITS                        13
K0134  45101        1.00     114.00  NAPHTHA                                23
K0134  45102        4.90     106.17  ISOMERS OF XYLENE                      33
K0134  45202        3.90      92.15  TOLUENE                                43
K0134  43551        7.10      58.08  ACETONE                                53
K0134  43552        7.70      72.10  METHYL ETHYL KETONE                    63
K0134  43560        3.10     100.16  METHYL ISOBUTYL KETONE                 73
K0134  43301        1.00      32.04  METHYL ALCOHOL                         83
K0134  43302         .80      46.07  ETHYL ALCOHOL                          93
K0134  43304        2.80      60.09  ISOPROPYL ALCOHOL                     103
K0134  43305        4.00      74.12  N-BUTYL ALCOHOL                       113
K0134  43367       11.50      62.07  GLYCOL ETHER                          123
K0134  43433         .90      88.10  ETHYL ACETATE                         133
K0134  43435        9.50     116.16  N-BUTYL ACETATE                       143
K0134  43444         .80     104.00  ISOPROPYL ACETATE                     153
K0141     90.00  10.00  00.00    402007A                                     2
K0141  45102       22.00     106.17  ISOMERS OF XYLENE                      13
K0141  45202       54.00      92.15  TOLUENE                                23
K0141  43551       13.00      58.08  ACETONE                                33
K0141  43552       11.00      72.10  METHYL ETHYL KETONE                    43
K0145                            402007D                                     2
K0145  43817      100.00     165.83  PERCHLOROETHYLENE                      13
K0147     00.00  00.00  00.00    402004C                                     2
K0147  43118        6.40     114.00  MINERAL SPIRITS                        13
K0147  43233        4.60     114.23  N-OCTANE                               23
K0147  43248        6.40      84.16  CYCLOHEXANE                            33
K0147  45202       13.90      92.15  TOLUENE                                43
K0147  43552       16.60      72.10  METHYL ETHYL KETONE                    53
K0147  43304       11.70      60.09  ISOPROPYL ALCOHOL                      63
K0147  43305        4.00      74.12  N-BUTYL ALCOHOL                        73
K0147  43308        5.60     102.00  BUTYL CELLOSOLVE                       83
K0147  43435       30.80     116.16  N-BUTYL ACETATE                        93
K0148     00.00  00.00  00.00    402004B                                     2
K0148  43118       25.00     114.00  MINERAL SPIRITS                        13
K0148  45102        7.00     106.17  ISOMERS OF XYLENE                      23
K0148  45202       10.00      92.15  TOLUENE                                33
K0148  43561        8.00      98.15  CYCLOHEXANONE                          43
K0148  43551       13.00      58.08  ACETONE                                53
K0148  43552       18.00      72.10  METHYL ETHYL KETONE                    63
K0148  43304       15.00      60.09  ISOPROPYL ALCOHOL                      73
K0148  43445        4.00     140.00  METHYL AMYL ACETATE                    83
K0149     00.00  00.00  00.00    4[illegible]4A                              2
K0149  43118       21.40     114.00  MINERAL SPIRITS                        13
K0149  45202        9.40      92.15  TOLUENE                                23
K0149  43552       14.20      72.10  METHYL ETHYL KETONE                    33
K0149  43311       26.60      90.12  CELLOSOLVE                             43
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Table I-2 (continued)

K0149	43433	28.40	88.10	ETHYL ACETATE	53
K0156	00.00	00.00	00.00	402005A	2
K0156	43118	57.60	114.00	MINERAL SPIRITS	13
K0156	45102	4.00	106.17	ISOMERS OF XYLENE	23
K0156	45202	3.20	92.15	TOLUENE	33
K0156	43551	6.30	58.08	ACETONE	43
K0156	43552	6.80	72.10	METHYL ETHYL KETONE	53
K0156	43560	2.70	100.16	METHYL ISOBUTYL KETONE	63
K0156	43301	.70	32.04	METHYL ALCOHOL	73
K0156	43302	.50	46.07	ETHYL ALCOHOL	83
K0156	43304	1.90	60.09	ISOPROPYL ALCOHOL	93
K0156	43305	2.80	74.12	N-BUTYL ALCOHOL	103
K0156	43433	.30	88.10	ETHYL ACETATE	113
K0156	43435	2.90	116.16	N-BUTYL ACETATE	123
K0156	43444	.30	104.00	ISOPROPYL ACETATE	133
K0157	00.00	00.00	00.00	402005C	2
K0157	43118	13.20	114.00	MINERAL SPIRITS	13
K0157	43233	5.30	114.23	N-OCTANE	23
K0157	43248	13.20	84.16	CYCLOHEXANE	33
K0157	43435	12.40	116.16	N-BUTYL ACETATE	43
K0157	43452	5.00	132.00	2-ETHOXYETHYL ACETATE	53
K0157	43552	24.70	72.10	METHYL ETHYL KETONE	63
K0157	43623	13.90	120.91	DICHLORODIFLUOROMETHANE	73
K0157	45202	12.30	92.15	TOLUENE	83
K0162	95.00	05.00	3.30	402008E	2
K0162	43116	25.80	114.00	MINERAL SPIRITS	13
K0162	43204	.30	44.09	PROPANE	23
K0162	43212	.10	58.12	N-BUTANE	33
K0162	43220	.60	72.15	N-PENTANE	43
K0162	43205	2.40	42.08	PROPYLENE	53
K0162	43213	.90	56.10	BUTENE	63
K0162	43224	2.40	70.14	1-PENTENE	73
K0162	43502	3.30	30.03	FORMALDEHYDE	93
K0162	43551	.60	58.08	ACETONE	103
K0162	43206	.30	26.04	ACETYLENE	113
K0162	43304	7.00	60.09	ISOPROPYL ALCOHOL	123
K0162	43432	3.10	74.08	METHYL ACETATE	133
K0162	43435	29.60	116.16	N-BUTYL ACETATE	143
K0162	43444	12.50	104.00	ISOPROPYL ACETATE	153
K0162	43201	9.00	16.04	METHANE	163
K0162	45202	2.10	92.15	TOLUENE	183
K0164				402005D	2
K0164	43433	7.90	58.10	ETHYL ACETATE	13
K0164	43435	84.50	116.16	N-BUTYL ACETATE	23
K0164	43444	7.60	104.00	ISOPROPYL ACETATE	33
K0166				405002	2
K0166	43201	63.00	16.04	METHANE	13
K0166	43202	24.00	30.07	ETHANE	23
K0166	43204	12.00	44.09	PROPANE	33
K0166	43212	1.00	58.12	N-BUTANE	43
K0172	00.00	00.00	00.00	405003A	2
K0172	43302	47.60	46.07	ETHYL ALCOHOL	13
K0172	43303	24.30	60.09	N-PROPYL ALCOHOL	23
K0172	43304	10.70	60.09	ISOPROPYL ALCOHOL	33
K0172	43351	.90	74.12	ETHYL ETHER	43
K0172	43433	15.10	88.10	ETHYL ACETATE	53
K0172	43452	1.40	132.00	2-ETHOXYETHYL ACETATE	63
K0181	00.00	00.00	00.00	405005A	2
K0181	43118	5.40	114.00	MINERAL SPIRITS	13
K0181	43231	6.20	86.18	N-HEXANE	23
K0181	43232	6.60	100.21	N-HEPTANE	33
K0181	45202	12.00	92.15	TOLUENE	43

Table I-2 (continued)

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K0181  43551        .80     58.08  ACETONE                                    53
K0181  43552       7.80     72.10  METHYL ETHYL KETONE                        63
K0181  43119       1.00    114.00  LACTOL SPIRITS                             73
K0181  43302       8.60     46.07  ETHYL ALCOHOL                              83
K0181  43303        .30     60.09  N-PROPYL ALCOHOL                           93
K0181  43304      10.80     60.09  ISOPROPYL ALCOHOL                         103
K0181  43433      18.20     88.10  ETHYL ACETATE                             113
K0181  43434       1.30    102.13  PROPYL ACETATE                            123
K0181  43444      20.10    104.00  ISOPROPYL ACETATE                         133
K0181  43452        .90    132.00  2-ETHOXYETHYL ACETATE                     143
K0182     00.00  00.00  00.00    405305D                                       2
K0182  43118      51.00    114.00  MINERAL SPIRITS                            13
K0182  43248      10.00     84.16  CYCLOHEXANE                                23
K0182  45106       7.00    134.21  ISOMERS OF DIETHYLBENZENE                  33
K0182  45203       6.00    106.17  ETHYLBENZENE                               43
K0182  43301       6.00     32.04  METHYL ALCOHOL                             53
K0182  43304       6.00     60.09  ISOPROPYL ALCOHOL                          63
K0182  43305       6.00     74.12  N-BUTYL ALCOHOL                            73
K0182  43435       8.00    116.16  N-BUTYL ACETATE                            83
K0183     00.00  00.00  00.00    405005B                                       2
K0183  43118      33.00    114.60  MINERAL SPIRITS                            13
K0183  45102       4.00    106.17  ISOMERS OF XYLENE                          23
K0183  45202      13.00     92.15  TOLUENE                                    33
K0185     00.00  00.00  00.00    403001P                                       2
K0185  45202     100.00     92.15  TOLUENE                                    13
K0188                            4030010                                       2
K0188  43105       1.30     86.18  ISOMERS OF HEXANE                          13
K0188  43112        .30    170.33  ISOMERS OF DODECANE                        23
K0188  43115       4.50     98.19  C-7 CYCLOPARAFFINS                         33
K0188  43116       1.30    112.23  C-8 CYCLOPARAFFINS                         43
K0188  43122       7.10     72.15  ISOMERS OF PENTANE                         53
K0188  43204      21.30     44.09  PROPANE                                    63
K0188  43212      16.60     58.12  N-BUTANE                                   73
K0188  43214       8.30     58.12  ISOBUTANE                                  83
K0188  43220       5.80     72.15  N-PENTANE                                  93
K0188  43231       4.20     86.13  N-HEXANE                                  103
K0188  43201      16.80     16.04  METHANE                                   113
K0188  43202      11.90     30.07  ETHANE                                    123
K0188  45201        .60     78.12  BENZENE                                   133
K0195                            901005                                        2
K0195  43201     100.00     16.04  METHANE                                    13
K0196                              935103                                      2
K0196  43231      20.70     86.18  N-HEXANE                                   13
K0196  43248      20.70     84.16  CYCLOHEXANE                                23
K0196  45102       2.60    106.17  ISOMERS OF XYLENE                          33
K0196  45202       5.20     92.15  TOLUENE                                    43
K0196  45203       4.30    106.17  ETHYLBENZENE                               53
K0196  43551       3.20     58.08  ACETONE                                    63
K0196  43552       5.60     72.10  METHYL ETHYL KETONE                        73
K0196  43559       0.70    100.16  METHYL N-BUTYL KETONE                      83
K0196  43560       0.60    100.16  METHYL ISOBUTYL KETONE                     93
K0196  43301       3.90     32.04  METHYL ALCOHOL                            103
K0196  43302       0.60     46.07  ETHYL ALCOHOL                             113
K0196  43304      16.40     60.09  ISOPROPYL ALCOHOL                         123
K0196  43305       1.60     74.12  N-BUTYL ALCOHOL                           133
K0196  43306       0.60     74.12  ISOBUTYL ALCOHOL                          143
K0196  43369       0.80     76.00  PROPYLENE GLYCOL                          153
K0196  43370       0.60     62.07  ETHYLENE GLYCOL                           163
K0196  43435       2.50    116.16  N-BUTYL ACETATE                           173
K0196  43446       1.50    116.16  ISOBUTYL ACETATE                          183
K0196  43451       6.10    144.21  ISOBUTYL ISOBUTYRATE                      203
K0196  43452       1.30    132.00  2-ETHOXYETHYL ACETATE                     213
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Table I-2 (continued)

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K0197                        0.60     935702                                          2
K0197  43214      5.30      58.12  ISOBUTANE                                         13
K0197  45101      4.50     114.00  NAPHTHA                                           23
K0197  43502      0.60      30.03  FORMALDEHYDE                                      33
K0197  43551      1.40      58.08  ACETONE                                           43
K0197  43302     36.90      46.07  ETHYL ALCOHOL                                     53
K0197  43304     38.50      60.09  ISOPROPYL ALCOHOL                                 63
K0197  43367      8.30      62.07  GLYCOL ETHER                                      73
K0197  43369      3.20      76.00  PROPYLENE GLYCOL                                  83
K0197  43435      1.30     116.16  N-BUTYL ACETATE                                   93
K0202                             949939A                                             2
K0202  43123       .10     136.23  TERPENES                                          33
K0202  43201     98.60      16.04  METHANE                                           43
K0202  43202       .10      30.07  ETHANE                                            53
K0202  43204       .10      44.09  PROPANE                                           63
K0202  43212       .20      58.12  N-BUTANE                                          73
K0202  43214       .10      58.12  ISOBUTANE                                         83
K0202  43220       .10      72.15  N-PENTANE                                         93
K0202  43242       .10      70.14  CYCLOPENTANE                                     103
K0202  43817       .30     165.83  PERCHLOROETHYLENE                                113
K0202  45102       .10     106.17  ISOMERS OF XYLENE                                123
K0202  45202       .10      92.15  TOLUENE                                          133
K0203     00.00  00.00  00.00     9499998                                             2
K0203  43201     70.00      16.04  METHANE                                           13
K0203  43202     20.00      30.07  ETHANE                                            23
K0203  43302      2.00      46.07  ETHYL ALCOHOL                                     33
K0203  43304      2.00      60.09  ISOPROPYL ALCOHOL                                 43
K0203  43434      2.00     102.13  PROPYL ACETATE                                    53
K0203  43551      2.00      58.08  ACETONE                                           63
K0203  43720      1.00      31.06  METHYLAMINE                                       73
K0203  43740      1.00      59.11  TRIMETHYL AMINE                                   83
K0211     00.00  00.00  00.00     302229                                              2
K0211  43302    100.00      46.07  ETHYL ALCOHOL                                     13
K0217                             390087                                              2
K0217  43203      2.80      28.05  ETHYLENE                                          13
K0217  43205      5.50      42.09  PROPYLENE                                         23
K0217  43213      6.40      56.10  BUTENE                                            33
K0217  43201     40.90      16.04  METHANE                                           43
K0217  43202      1.40      30.07  ETHANE                                            53
K0217  45201     43.00      78.12  BENZENE                                           63
K0219     00.00  00.00  00.00     402001B                                             2
K0219  43551    100.00      58.08  ACETONE                                           13
K0220     00.00  00.00  00.00     402001C                                             2
K0220  43433    100.00      88.10  ETHYL ACETATE                                     13
K0221     00.00  00.00  00.00     402001D                                             2
K0221  43552    100.00      72.10  METHYL ETHYL KETONE                               13
K0222     00.00  00.00  00.00     402005E                                             2
K0222  43452    100.00     132.00  2-ETHOXYETHEL ACETATE                             13
K0223                             402003E                                             2
K0223  45102    100.00     106.17  ISOMERS OF XYLENE                                 13
K0226                             402009F                                             2
K0226  43302    100.00      46.07  ETHYL ALCOHOL                                     13
K0227                             402009G                                             2
K0227  43304    100.00      60.09  ISOPROPYL ALCOHOL                                 13
K0228     00.00  00.00  00.00     40200913                                            2
K0226  43444    100.00     104.00  ISOPROPYL ACETATE                                 13
K0229     00.00  00.00  00.00     40200915                                            2
K0229  43119    100.00     114.00  LACTOL SPIRITS                                    13
K0230     00.00  00.00  00.00     403001K                                             2
K0230  43231    100.00      86.18  N-HEXANE                                          13
K0231     00.00  00.00  00.00     403001M                                             2
K0231  43122    100.00      72.15  ISOMERS OF PENTANE                                13
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Table I-2 (continued)

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K0232                              403003                                              2
K0232  43204       90.60     44.09  PROPANE                                           13
K0232  43214         .20     58.12  ISOBUTANE                                         23
K0232  43205        5.10     42.08  PROPYLENE                                         33
K0232  43202        4.10     30.07  ETHANE                                            43
K0271     00.00  00.00  00.00    401002C                                               2
K0271  43624      100.00    131.40  TRICHLOROETHYLENE                                 13
K0272     95.00   5.00  00.00    301026A                                               2
K0272  43106        4.70    100.21  ISOMERS OF HEPTANE                                13
K0272  43107         .60    114.23  ISOMERS OF OCTANE                                 23
K0272  43115       43.20     98.19  C-7 CYCLOPARAFFINS                                33
K0272  43116        6.00    112.23  C-8 CYCLOPARAFFINS                                43
K0272  43231        5.80     86.18  N-HEXANE                                          53
K0272  43232        1.90    100.21  N-HEPTANE                                         63
K0272  43233         .40    114.23  N-OCTANE                                          73
K0272  43248       16.30     84.16  CYCLOHEXANE                                       83
K0272  43262       17.70     84.16  METHYLCYCLOPENTANE                                93
K0272  45202         .40     92.15  TOLUENE                                          103
K0272  45201        2.80     78.12  BENZENE                                          113
K0273     00.00  00.00  00.00    301026B                                               2
K0273  43105       24.20     86.18  ISOMERS OF HEXANE                                 13
K0273  43106         .20    100.21  ISOMERS OF HEPTANE                                23
K0273  43231       33.60     86.18  N-HEXANE                                          33
K0273  43242         .20     70.14  CYCLOPENTANE                                      43
K0273  43248         .40     84.16  CYCLOHEXANE                                       53
K0273  43262       33.70     84.16  METHYLCYCLOPENTANE                                63
K0273  45201        7.70     78.12  BENZENE                                           73
K0274     00.00  00.00  00.00    301026C                                               2
K0274  43115       99.84     98.19  C-7 CYCLOPARAFFINS                                13
K0274  43116         .08    112.23  C-8 CYCLOPARAFFINS                                23
K0274  43248         .04     84.16  CYCLOHEXANE                                       33
K0274  43262         .04     84.16  METHYLCYCLOPENTANE                                43
K0275     00.00  00.00  00.00    401002B                                               2
K0275  43802      100.00     84.94  DICHLOROMETHANE                                   13
K0276     00.00  00.00  00.00    301019B                                               2
K0276  43204         .90     44.09  PROPANE                                           13
K0276  43212        2.20     58.12  N-BUTANE                                          23
K0276  43214         .40     58.12  ISOBUTANE                                         33
K0276  43205        3.10     42.08  PROPYLENE                                         43
K0276  43551        8.60     58.08  ACETONE                                           53
K0276  43206        4.40     26.04  ACETYLENE                                         63
K0276  43201       80.00     16.04  METHANE                                           73
K0276  43202         .40     30.07  ETHANE                                            83
K0277     00.00  00.00  00.00    491992F                                               2
K0277  43821      100.00    187.38  TRICHLOROTRIFLUOROETHANE                          13
K0279     90.00  10.00  00.00    402008B                                               2
K0279  43203        2.40     28.05  ETHYLENE                                          13
K0279  45202       10.60     92.15  TOLUENE                                           23
K0279  43551       30.20     58.08  ACETONE                                           33
K0279  43201       39.90     16.04  METHANE                                           43
K0279  43202        2.40     30.07  ETHANE                                            53
K0279  45201       14.50     78.12  BENZENE                                           63
K0280     00.00  00.00  00.00    402006E                                               2
K0280  45202        8.70     92.15  TOLUENE                                           13
K0280  43551       68.90     58.08  ACETONE                                           23
K0280  45201       22.40     78.12  BENZENE                                           33
K0282     00.00  00.00  00.00    402006G                                               2
K0282  45101      100.00    114.00  NAPHTHA                                           13
K0283     00.00  00.00  00.00    402006H                                               2
K0283  43118      100.00    114.00  MINERAL SPIRITS                                   13
K0287     00.00  00.00  00.00    402007E                                               2
K0287  45201      100.00     78.12  BENZENE                                           13
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Table I-2 (continued)

```
K0288                                    4020098                                       2
K0288  43435       100.00     116.16  N-BUTYL ACETATE                                 13
K0289                                    402909C                                       2
K0269  43305       100.00      74.12  N-BUTYL ALCOHOL                                 13
K0290      00.00  00.00  00.00      40200906                                           2
K0290  43311       100.00      90.12  CELLOSOLVE                                      13
K0291      00.00  00.00  00.00      402009K                                            2
K0291  43301       100.00      32.04  METHYL ALCOHOL                                  13
K0292      00.00  00.00  00.00      49200908                                           2
K0252  43450       100.00      73.09  DIMETHYLFORMAMIDE                               13
K0293                                    402999A                                       2
K0293  43231        34.00      86.18  N-HEXANE                                        13
K0293  43248        43.10      84.16  CYCLOHEXANE                                     23
K0293  45102         6.60     106.17  ISOMERS OF XYLENE                               33
K0293  45202         7.60      52.15  TOLUENE                                         43
K0293  45203         8.70     106.17  ETHYLBENZENE                                    53
K0294      00.00  00.00  00.00      4029998                                            2
K0294  45102        41.60     106.17  ISOMERS OF XYLENE                               13
K0294  45104        12.20     120.19  ISOMERS OF ETHYLTOLUENE                         23
K0294  45107        20.10     120.19  ISOMERS OF TRIMETHYLBENZENE                     33
K0294  45108         2.10     120.19  ISOMERS OF PROPYLBENZENE                        43
K0294  45202        13.70      92.13  TOLUENE                                         53
K0294  45203        10.30     106.17  ETHYLBENZENE                                    63
K0296      00.00  00.00  00.00      403001C                                            2
K0296  43115         1.30      98.19  C-7 CYCLOPARAFFINS                              13
K0296  43116          .50     112.23  C-8 CYCLOPARAFFINS                              23
K0296  43122         1.50      72.15  ISOMERS OF PENTANE                              33
K0296  43204        17.60      44.09  PROPANE                                         43
K0296  43212        27.10      58.12  N-BUTANE                                        53
K0296  43214         1.50      58.12  ISOBUTANE                                       63
K0296  43220        14.60      72.15  N-PENTANE                                       73
K0296  43231         7.90      86.18  N-HEXANE                                        83
K0296  43232         9.20     100.21  N-HEPTANE                                       93
K0296  43233         6.90     114.23  N-OCTANE                                       103
K0296  43201         5.20      16.04  METHANE                                        113
K0296  43202         5.60      30.07  ETHANE                                         123
K0296  45201          .10      78.12  BENZENE                                        133
K0297      00.00  00.00  00.00      403001D                                            2
K0297  43105         5.10      86.18  ISOMERS OF HEXANE                               13
K0297  43106         5.00     100.21  ISOMERS OF HEPTANE                              23
K0297  43107          .40     114.23  ISOMERS OF OCTANE                               33
K0297  43122        11.20      72.15  ISOMERS OF PENTANE                              43
K0297  43204        16.10      44.09  PROPANE                                         53
K0297  43212        20.80      58.12  N-BUTANE                                        63
K0297  43214         9.30      58.12  ISOBUTANE                                       73
K0297  43229        10.10      72.15  N-PENTANE                                       83
K0297  43231         4.70      86.19  N-HEXANE                                        93
K0297  43232         2.00     100.21  N-HEPTANE                                      103
K0297  45202         1.40      92.15  TOLUENE                                        113
K0297  43201         8.80      16.04  METHANE                                        123
K0297  43202         2.70      30.07  ETHANE                                         133
K0297  45201         2.40      78.12  BENZENE                                        143
K0298      00.00  00.00  00.00      403001F                                            2
K0298  45201       100.00      78.12  BENZENE                                         13
K0301                                    4030011                                       2
K0301  43232       100.00     100.21  N-HEPTANE                                       13
K0303                                    40300115                                      2
K0303  43220       100.00      72.15  N-PENTANE                                       13
K0305                                    406002                                        2
K0305  43204        15.80      44.09  PROPANE                                         13
K0305  43212        30.20      58.12  N-BUTANE                                        23
K0305  43220        18.50      72.15  N-PENTANE                                       33
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Table I-2 (continued)

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K0305  43231        8.80     86.15  N-HEXANE                            43
K0305  43232       10.80    100.21  N-HEPTANE                           53
K0305  43233        9.60    114.23  N-OCTANE                            63
K0305  43201        2.60     16.04  METHANE                             73
K0305  43202        3.70     30.07  ETHANE                              83
K0306     00.00  00.00  00.00    303009A                                 2
K0306  43231        1.67     86.18  N-HEXANE                            13
K0306  43232        6.86    100.21  N-HEPTANE                           23
K0306  43822       83.86     93.19  TRIMETHYLFLUORISILANE               33
K0306  45201        3.05     78.12  BENZENE                             43
K0306  45202        4.56     92.15  TOLUENE                             53
K0307     85.00  15.00  00.00     913081                                 2
K0307  43122        0.15     72.15  ISOMERS OF PENTANE                  13
K0307  43204        0.35     44.09  PROPANE                             23
K0307  43212        0.24     58.12  N-BUTANE                            33
K0307  43214        0.11     58.12  ISOBUTANE                           43
K0307  43120        0.92     56.10  ISOMERS OF BUTENE                   53
K0307  43203       19.11     28.05  ETHYLENE                            63
K0307  43205        3.93     42.08  PROPYLENE                           73
K0307  43213        0.81     56.10  BUTENE                              83
K0307  43218        0.52     54.09  1,3-BUTADIENE                       93
K0307  43223        0.17     70.14  3-METHYL-1-BUTENE                  103
K0307  43000       44.59     66.00  UNIDENTIFIED HYDROCARBONS          113
K0307  43206        8.40     26.04  ACETYLENE                          123
K0307  43209        0.41     40.06  METHYLACETYLENE                    133
K0307  43201        9.82     16.04  METHANE                            143
K0307  43202       10.47     30.07  ETHANE                             153
K0316     00.00  00.00  00.00     306008A                                2
K0316  43105        1.60     86.18  ISOMERS OF HEXANE                   13
K0316  43106         .80    100.21  ISOMERS OF HEPTANE                  23
K0316  43107         .40    114.23  ISOMERS OF OCTANE                   33
K0316  43108         .50    128.26  ISOMERS OF NONANE                   43
K0316  43109         .30    142.29  ISOMERS OF DECANE                   53
K0316  43115         .20     98.19  C-7 CYCLOPARAFFINS                  63
K0316  43117         .10    126.26  C-9 CYCLOPARAFFINS                  73
K0316  43122        7.80     72.15  ISOMERS OF PENTANE                  83
K0316  43204       11.50     44.09  PROPANE                             93
K0316  43212       18.30     58.12  N-BUTANE                           103
K0316  43214        7.40     58.12  ISOBUTANE                          113
K0316  43220        7.70     72.15  N-PENTANE                          123
K0316  43231        3.40     86.18  N-HEXANE                           133
K0316  43232        1.40    100.21  N-HEPTANE                          143
K0316  43233        1.80    114.23  N-OCTANE                           153
K0316  43235         .60    128.26  N-NONANE                           163
K0316  43238         .80    142.29  N-DECANE                           173
K0316  43248         .10     84.16  CYCLOHEXANE                        183
K0316  43205         .10     42.08  PROPYLENE                          193
K0316  45102         .20    106.17  ISOMERS OF XYLENE                  203
K0316  45202         .50     92.15  TOLUENE                            213
K0316  43201       28.60     16.04  METHANE                            223
K0316  43202        5.80     30.07  ETHANE                             233
K0316  45201         .10     78.12  BENZENE                            243
K0321     00.00  00.00  00.00     306008P                                2
K0321  43105        5.50     86.18  ISOMERS OF HEXANE                   13
K0321  43106        4.10    100.21  ISOMERS OF HEPTANE                  23
K0321  43107        2.80    114.23  ISOMERS OF OCTANE                   33
K0321  43108        3.10    128.26  ISOMERS OF NONANE                   43
K0321  43109        1.90    142.29  ISOMERS OF DECANE                   53
K0321  43115        1.10     98.19  C-7 CYCLOPARAFFINS                  63
K0321  43116         .10    112.23  C-8 CYCLOPARAFFINS                  73
K0321  43117         .20    126.26  C-9 CYCLOPARAFFINS                  83
K0321  43122        6.60     72.15  ISOMERS OF PENTANE                  93
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Table I-2(continued)

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K0321  43204       3.70     44.09  PROPANE                                 103
K0321  43212       8.10     58.12  N-BUTANE                                123
K0321  43214        .80     58.12  ISOBUTANE                               133
K0321  43220      11.10     72.15  N-PENTANE                               143
K0321  43231      11.00     86.18  N-HEXANE                                153
K0321  43232       8.50    100.21  N-HEPTANE                               163
K0321  43233      12.00    114.23  N-OCTANE                                173
K0321  43235       3.90    128.26  N-NONANE                                183
K0321  43238       5.10    142.29  N-DECANE                                193
K0321  43248        .50     84.16  CYCLOHEXANE                             203
K0321  45102       1.30    106.17  ISOMERS OF XYLENE                       213
K0321  45202       3.00     92.15  TOLUENE                                 223
K0321  43201       3.30     16.04  METHANE                                 233
K0321  43202       1.20     30.07  ETHANE                                  243
K0321  45201        .50     78.12  BENZENE                                 253
K0330     90.00  10.00  12.20     907021                                     2
K0330  43212       3.20     58.12  N-BUTANE                                 13
K0330  43220       1.80     72.15  N-PENTANE                                23
K0330  43231       1.40     86.18  N-HEXANE                                 33
K0330  43232       0.40    100.21  N-HEPTANE                                43
K0330  43233       0.40    114.23  N-OCTANE                                 53
K0330  43235       0.40    128.26  N-NONANE                                 63
K0330  43260      35.10    212.42  N-PENTADECANE                            73
K0330  43203      10.70     28.05  ETHYLENE                                 83
K0330  43205       4.00     42.08  PROPYLENE                                93
K0330  45101      17.60    114.00  NAPHTHA                                 103
K0330  45102       0.30    106.17  ISOMERS OF XYLENE                       113
K0330  45107       0.20    120.19  ISOMERS OF TRIMETHYLBENZENE             123
K0330  45202       1.80     92.15  TOLUENE                                 133
K0330  43502      12.20     30.03  FORMALDEHYDE                            143
K0330  43206       3.80     26.04  ACETYLENE                               153
K0330  43201       4.40     16.04  METHANE                                 163
K0330  43202       0.40     30.07  ETHANE                                  173
K0330  45201       1.90     78.12  BENZENE                                 183
K0333     00.00  00.00  00.00     405004A                                    2
K0333  43204       3.30     44.09  PROPANE                                  13
K0333  43212      11.50     58.12  N-BUTANE                                 23
K0333  43214       1.80     58.12  ISOBUTANE                                33
K0333  43304        .90     60.09  ISOPROPYL ALCOHOL                        43
K0333  43802      34.90     84.94  DICHLOROMETHANE                          53
K0333  43201      37.70     16.04  METHANE                                  63
K0333  43202      10.00     30.07  ETHANE                                   73
K0334                   00.00     405002A                                    2
K0334  43204       3.00     44.09  PROPANE                                  13
K0334  43212       3.00     58.12  N-BUTANE                                 23
K0334  43214       1.00     58.12  ISOBUTANE                                33
K0334  43203      13.00     28.05  ETHYLENE                                 43
K0334  43205       3.00     42.08  PROPYLENE                                53
K0334  43213       1.00     56.10  BUTENE                                   63
K0334  43201      69.00     16.04  METHANE                                  73
K0334  43202       7.00     30.07  ETHANE                                   83
R0001     97.00   3.00            R0001    IP WOOD RIVER NO.4                2
R0001  43202       2.09     30.07  ETHANE                                   13
R0001  43204       1.78     44.09  PROPANE                                  23
R0001  43213        .79     56.10  1-BUTENE                                 33
R0001  43212        .98     58.12  N-BUTANE                                 43
R0001  43221       1.22     72.15  ISOPENTANE                               53
R0001  43227       1.05     70.14  CIS,2-PENTENE                            63
R0001  43245       3.63     84.16  1-HEXENE                                 73
R0001  43231       9.45     86.18  N-HEXANE                                 83
R0001  43268       2.67     98.19  3,3 DIMETHYL,1-PENTENE                   93
R0001  43247       6.39    100.21  2,4 DIMETHYLPENTANE                     103
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Table I-2 (continued)

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R0001  43264        3.69     98.19  1-HEPTENE                                    113
R0001  43232        1.50    100.21  N-HEPTANE                                    123
R0001  45202        5.62     92.15  TOLUENE                                      133
R0001  45203       11.25    106.17  ETHYL BENZENE                                143
R0001  45205       39.23    106.17  1,3 DIMETHYLBENZENE                          153
R0001  45204        8.66    106.17  ORTHOXYLENE                                  163
R0003     96.00   4.00             TABLE A-3                                       2
R0003  43800       77.00     35.00  C1-C3 PARAFFINS, NON-REACTIVES                13
P0003  45201        6.00     78.12  BENZENE                                       23
R0003  43200        1.00     35.00  C4+ PARAFFINS, OLEFINS                        33
R0003  43200       13.00     35.00  C4+ PARAFFINS, OLEFINS                        43
R0003  45100        3.00     95.64  PRIM. AND SEC-ALKYL BENZENES                  53
X0001                              X0001  70% STODDARD/30% PERCHLOROETHYLENE       2
X0001  43107         .20    114.23  ISOMERS OF OCTANE                             13
X0001  43108        8.20    128.26  ISOMERS OF NONANE                             23
X0001  43109       20.80    142.29  ISOMERS OF DECANE                             33
X0001  43110         .80    156.32  ISOMERS OF UNDECANE                           43
X0001  43817       70.00    165.83  PERCHLOROETHYLENE                             53
X0002     90.00  10.00  03.67             X0002 COM HGHWY VEH. PROFILE             2
X0002  43212        5.99     58.12  N-BUTANE                                      13
X0002  43122       16.55     72.15  ISOMERS OF PENTANE                            23
X0002  43105        6.19     86.18  ISOMERS OF HEXANE                             33
X0002  43106        5.50    100.21  ISOMERS OF HEPTANE                            43
X0002  43107        7.76    114.23  ISOMERS OF OCTANE                             53
X0002  43108         .98    128.26  ISOMERS OF NONANE                             63
X0002  43109        0.39    142.29  ISOMERS OF DECANE                             73
X0002  43203        6.87     28.05  ETHYLENE                                      83
X0002  43205        4.84     42.08  PROPYLENE                                     93
X0002  43120        4.15     56.10  ISOMERS OF BUTENE                            103
X0002  43121        3.95     70.14  ISOMERS OF PENTENE                           113
X0002  43245        1.26     84.16  1-HEXENE                                     123
X0002  43561        0.76     98.15  CYCLOHEXANONE                                133
X0002  45102        2.64    106.17  ISOMERS OF XYLENE                            143
X0002  45105        0.06    134.22  ISOMERS OF BUTYLBENZENE                      153
X0002  45107        2.15    120.19  ISOMERS OF TRIMETHYLBENZENE                  163
X0002  45202       10.61     92.15  TOLUENE                                      173
X0002  45203        0.56    106.17  ETHYLBENZENE                                 183
X0002  43502        3.67     30.03  FORMALDEHYDE                                 193
X0002  43206        5.26     26.04  ACETYLENE                                    203
X0002  43201        6.45     16.04  METHANE                                      213
X0002  43202        0.80     30.07  ETHANE                                       223
X0002  45201        2.69     78.12  BENZENE                                      233
X0002  43265        0.05    112.14  1-OCTENE                                     243
X0003     00.00  00.00  00.00    K0334(16%),K0172(13%),D0333(28%),K0181(41%)       2
X0003  43118        2.2     114.00  MINERAL SPIRITS                               13
X0003  43119         .41    114.00  LACTOL SPIRITS                                23
X0003  43201       23.02     16.04  METHANE                                       33
X0003  43202        4.06     30.07  ETHANE                                        43
X0003  43203        2.34     28.05  ETHYLENE                                      53
X0003  43204        1.46     44.09  PROPANE                                       63
X0003  43205         .54     42.08  PROPYLENE                                     73
X0003  43212        3.74     58.12  N-BUTANE                                      83
X0003  43213         .18     56.10  BUTENE                                        93
X0003  43214         .68     58.12  ISOBUTANE                                    103
X0003  43231        2.54     86.18  N-HEXANE                                     113
X0003  43232        2.7     100.21  N-HEPTANE                                    123
X0003  43302        9.73     46.07  ETHYL ALCOHOL                                133
X0003  43303        3.28     60.09  N-PROPYL ALCOHOL                             143
X0003  43304        6.07     60.09  ISOPROPYL ALCOHOL                            153
X0003  43351         .12     74.12  ETHYL ETHER                                  163
X0003  43433        9.42     88.10  ETHYL ACETATE                                173
X0003  43434         .53    102.13  PROPYL ACETATE                               183
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Table I-2 (continued)

X0003	43444	8.24	104.00	ISOPROPYL ACETATE	193
X0003	43452	.55	132.00	2-ETHOXYETHYL ACETATE	203
X0003	43551	.33	58.08	ACETONE	213
X0003	43552	3.20	72.10	METHYL ETHYL KETONE	223
X0003	43802	9.80	84.94	DICHLOROMETHANE	233
X0003	45202	4.9	92.15	TOLUENE	243
X0004	00.00	00.00	00.00	X0004 D0101=33%,K0098=33%,K0315=33%	2
X0004	43105	2.20	86.18	ISOMERS OF HEXANE	13
X0004	43107	1.87	114.23	ISOMERS OF OCTANE	23
X0004	43108	6.87	128.26	ISOMERS OF NONANE	33
X0004	43109	5.53	142.29	ISOMERS OF DECANE	43
X0004	43115	.80	98.19	C-7 CYCLOPARAFFINS	53
X0004	43116	.20	112.23	C-8 CYCLOPARAFFINS	63
X0004	43117	1.60	126.26	C-9 CYCLOPARAFFINS	73
X0004	43122	.13	72.15	ISOMERS OF PENTANE	83
X0004	43204	.23	44.09	PROPANE	93
X0004	43212	.75	58.12	N-BUTANE	103
X0004	43213	.13	56.10	BUTENE	113
X0004	43214	.17	58.12	ISOBUTANE	123
X0004	43220	4.49	72.15	N-PENTANE	133
X0004	43224	.83	70.14	1-PENTENE	143
X0004	43228	7.40	70.14	2-METHYL-2-BUTENE	153
X0004	43231	7.50	86.18	N-HEXANE	163
X0004	43232	3.73	100.21	N-HEPTANE	173
X0004	43233	5.67	114.23	N-OCTANE	183
X0004	43235	4.94	128.26	N-NONANE	193
X0004	43241	6.77	156.32	N-UNDECANE	203
X0004	43248	.50	84.16	CYCLOHEXANE	213
X0004	43255	6.07	170.34	N-DODECANE	223
X0004	43258	5.90	184.36	N-TRIDECANE	233
X0004	43259	3.90	198.40	N-TETRADECANE	243
X0004	43260	2.40	212.42	N-PENTADECANE	253
X0004	45102	6.83	106.17	ISOMERS OF XYLENE	263
X0004	45104	2.17	120.19	ISOMERS OF ETHYLTOLUENE	273
X0004	45105	1.47	134.22	ISOMERS OF BUTYLBENZENE	283
X0004	45107	1.83	120.19	ISOMERS OF TRIMETHYLBENZENE	293
X0004	45201	1.63	78.12	BENZENE	303
X0004	45202	5.30	92.15	TOLUENE	313
X0005	00.00	00.00	00.00	X0005 METHYL ISOBUTYL KETONE	2
X0005	43560	100.00	100.16	METHYL ISOBUTYL KETONE	13
X0006				X0006	2
X0006	43105	8.90	86.18	ISOMERS OF HEXANE	13
X0006	43106	2.19	100.21	ISOMERS OF HEPTANE	23
X0006	43107	2.24	114.23	ISOMERS OF OCTANE	33
X0006	43108	.26	128.26	ISOMERS OF NONANE	43
X0006	43115	.24	98.19	C-7CYCLOPARAFFINS	53
X0006	43122	27.56	72.15	ISOMERS OF PENTANE	63
X0006	43204	1.71	44.09	PROPANE	73
X0006	43212	18.94	58.12	N-BUTANE	83
X0006	43213	1.73	56.10	BUTENE	93
X0006	43214	6.31	58.12	ISOBUTANE	103
X0006	43220	10.28	72.15	N-PENTANE	113
X0006	43224	6.02	70.14	1-PENTENE	123
X0006	43231	2.56	86.18	N-HEXANE	133
X0006	43232	.70	100.21	N-HEPTANE	143
X0006	43233	.16	114.23	N-OCTANE	153
X0006	43235	.03	128.26	N-NONANE	163
X0006	43238	.12	142.29	N-DECANE	173
X0006	43248	2.28	84.16	CYCLOHEXANE	183
X0006	45102	2.18	106.17	ISOMERS OF XYLENE	193
X0006	45103	.23	134.22	DIMETHYLETHYLBENZENE	203
X0006	45104	.60	120.19	ISOMERS OF ETHYLTOLUENE	213

Table I-2 (continued)

X0006	45105	.08	134.22	ISOMERS OF BUTYLBENZENE	223
X0006	45107	.54	120.19	ISOMERS OF TRIMETHYLBENZENE	233
X0006	45108	.02	120.19	ISOMERS OF PROPYLBENZENE	243
X0006	45201	1.17	78.12	BENZENE	253
X0006	45202	2.47	92.15	TOLUENE	263
X0007	00.00	00.00	00.15	X0007	2
X0007	43105	.40	86.18	ISOMERS OF HEXANE	13
X0007	43107	.35	114.23	ISOMERS OF OCTANE	23
X0007	43108	7.22	128.25	ISOMERS OF NONANE	33
X0007	43109	17.54	142.29	ISOMERS OF DECANE	43
X0007	43110	.63	156.32	ISOMERS OF UNDECANE	53
X0007	43115	.52	98.19	C-7 CYCLOPARAFFINS	63
X0007	43116	.06	112.23	C-8 CYCLOPARAFFINS	73
X0007	43117	.11	126.26	C-9 CYCLOPARAFFINS	83
X0007	43118	.53	114.00	MINERAL SPIRITS	93
X0007	43119	.01	114.00	LACTOL SPIRITS	103
X0007	43122	.10	72.15	ISOMERS OF PENTANE	113
X0007	43201	.76	16.04	METHANE	123
X0007	43202	.13	30.07	ETHANE	133
X0007	43203	.08	28.05	ETHYLENE	143
X0007	43204	.12	44.09	PROPANE	153
X0007	43205	.02	42.08	PROPYLENE	163
X0007	43212	.30	58.12	N-BUTANE	173
X0007	43213	.02	56.10	BUTENE	183
X0007	43214	1.41	58.12	ISOBUTANE	193
X0007	43220	.41	72.15	N-PENTANE	203
X0007	43224	.04	70.14	1 PENTENE	213
X0007	43228	.51	70.14	2-METHYL 2-BUTENE	223
X0007	43231	4.51	86.18	N-HEXANE	233
X0007	43232	.35	100.21	N-HEPTANE	243
X0007	43233	.39	114.23	N-OCTANE	253
X0007	43235	.34	128.26	N-NONANE	263
X0007	43241	.47	156.32	N-UNDECANE	273
X0007	43248	3.84	84.16	CYCLOHEXANE	283
X0007	43255	.42	170.34	N-DODECANE	293
X0007	43258	.41	184.36	N-TRIDECANE	303
X0007	43259	.27	198.40	N-TETRADECANE	313
X0007	43260	.17	212.42	N-PENTADECANE	323
X0007	43301	2.11	32.04	METHYL ALCOHOL	333
X0007	43302	11.07	46.07	ETHYL ALCOHOL	343
X0007	43303	.11	60.09	N-PROPYL ALCOHOL	353
X0007	43304	14.29	60.09	ISOPROPYL ALCOHOL	363
X0007	43305	.29	74.12	N-BUTYL ALCOHOL	373
X0007	43306	.11	74.12	ISOBUTYL ALCOHOL	383
X0007	43367	2.08	62.07	GLYCOL ETHER	393
X0007	43369	.95	76.00	PROPYLENE GLYCOL	403
X0007	43370	.11	62.07	ETHYLENE GLYCOL	413
X0007	43433	.31	88.10	ETHYL ACETATE	423
X0007	43434	.02	102.13	PROPYL ACETATE	433
X0007	43435	.79	116.16	N-BUTYL ACETATE	443
X0007	43444	.27	104.00	ISOPROPYL ACETATE	453
X0007	43446	.28	116.16	ISOBUTYL ACETATE	463
X0007	43451	1.12	144.21	ISOBUTYL ISOBUTYRATE	473
X0007	43452	.26	132.03	2-ETHOXYETHYL ACETATE	483
X0007	43502	.15	30.03	FORMALDEHYDE	493
X0007	43551	3.40	58.08	ACETONE	503
X0007	43552	3.63	72.10	METHYL ETHYL KETONE	513
X0007	43559	.13	100.16	METHYL N-BUTYL KETONE	523
X0007	43560	1.35	100.16	METHYL ISOBUTYL KETONE	533
X0007	43802	.32	84.94	DICHLORO METHANE	543
X0007	43817	6.10	165.83	PERCHLOROETHYLENE	553
X0007	43819	.30	173.85	METHYLENE BROMIDE	563

Table I-2 (continued)

X0007	45101	1.13	114.00	NAPHTHA	573
X0007	45102	2.40	106.17	ISOMERS OF XYLENE	583
X0007	45104	.15	120.19	ISOMERS OF ETHYLTOLUENE	593
X0007	45105	.10	134.22	ISOMERS OF BUTYLBENZENE	603
X0007	45107	.13	120.19	ISOMERS OF TRIMETHYLBENZENE	613
X0007	45201	.48	78.12	BENZENE	623
X0007	45202	2.63	92.15	TOLUENE	633
X0007	45203	.79	106.17	ETHYLBENZENE	643
X0008			00.00	K0272(33%),K0273(33%),K0274(33%)	2
X0008	43105	8.10	86.18	ISOMERS OF HEXANE	13
X0008	43106	1.60	100.21	ISOMERS OF HEPTANE	23
X0008	43107	0.30	114.23	ISOMERS OF OCTANE	33
X0008	43115	47.70	98.19	C-7 CYCLOPARAFFINS	43
X0008	43116	2.10	112.23	C-8 CYCLOPARAFFINS	53
X0008	43231	13.10	86.18	HEXANE	63
X0008	43232	0.60	100.21	HEPTANE	73
X0008	43233	0.10	114.23	OCTANE	83
X0008	43242	0.10	70.14	CYCLOPENTANE	93
X0008	43248	5.60	84.16	CYCLOHEXANE	103
X0008	43262	17.10	84.16	METHYLCYCLOPENTANE	113
X0008	45202	0.10	92.15	TOLUENE	123
X0008	45201	3.50	78.12	BENZENE	133
X0009			00.00	K0148(25%),K0155(25%),402006C(25%),402007B(25%)	2
X0009	43118	38.08	114.00	MINERAL SPIRITS	13
X0009	45102	2.75	106.16	XYLENE	23
X0009	45202	12.00	92.13	TOLUENE	33
X0009	43561	2.00	98.15	CYCLOHEXANONE	43
X0009	43551	12.33	58.08	ACETONE	53
X0009	43552	12.05	72.10	METHYL ETHLY KETONE	63
X0009	43304	6.53	60.09	ISO-PROPYL ALCOHOL	73
X0009	43445	1.00	140.00	METHYL AMYL ACETATE	83
X0009	43560	0.68	100.16	METHYL ISOBUTYL KETONE	93
X0009	43301	0.18	32.04	METHYL ALCOHOL	103
X0009	43302	0.13	46.07	ETHYL ALCOHOL	113
X0009	43305	1.78	74.12	N-BUTYL ALCOHOL	123
X0009	43433	0.80	88.10	ETHYL ACETATE	133
X0009	43435	3.58	116.16	N-BUTYL ACETATE	143
X0009	43444	4.25	104.00	ISOPROPYL ACETATE	153
X0009	43233	0.20	114.23	OCTANE	163
X0009	43248	9.70	84.16	CYCLOHEXANE	173
X0010			00.00	12.5% OF K0148;402004D&E;K0134,56;K0162,4;K0092	2
X0010	43118	31.26	114.00	MINERAL SPIRITS	13
X0010	45102	2.59	106.17	XYLENE	23
X0010	45202	2.88	92.15	TOLUENE	33
X0010	43561	1.00	98.19	CYCLOHEXANONE	43
X0010	43551	4.78	58.08	ACETONE	53
X0010	43552	5.56	72.10	METHYL ETHYL KETONE	63
X0010	43304	3.90	60.09	ISOOPROPYL ALCOHOL	73
X0010	43445	0.50	140.00	METHYL AMYL ACETATE	83
X0010	43220	0.08	72.15	N-PENTANE	93
X0010	45101	2.75	114.00	NAPTHA	110
X0010	43205	0.30	42.08	PROPYLENE	113
X0010	43560	1.30	100.16	METHYL ISOBUTYL KETONE	123
X0010	43213	0.11	56.10	BUTENE	133
X0010	43301	0.41	32.04	METHYL ALCOHOL	143
X0010	43224	0.30	70.14	1-PENTENE	153
X0010	43302	0.31	46.07	ETHYL ALCOHOL	163
X0010	43502	0.41	30.03	FORMALDEHYDE	173
X0010	43305	1.66	74.12	N-BUTYL ALCOHOL	183
X0010	43367	2.11	62.07	GLYCOL ETHER	203
X0010	43432	0.39	74.08	METHYL ACETATE	213
X0010	43433	1.46	88.10	ETHYL ACETATE	223

Table I-2 (continued)

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X0010  43435       19.25    116.16  N-BUTYL ACETATE                        233
X0010  43444        2.98    104.00  ISOPROPYL ACETATE                      243
X0010  43204        0.43     44.09  PROPANE                                253
X0010  43212        2.94     58.12  N-BUTANE                               263
X0010  43203        0.25     28.05  ETHYLENE                               273
X0010  43201        9.44     16.04  METHANE                                283
X0010  43202        0.63     30.07  ETHANE                                 293
X0011                     03.11  14.3% OF K0164,6;K0172,K0183,4050648,405005C  2
X0011  43204        1.71     44.09  PROPANE                                 13
X0011  43212        0.14     58.12  N-BUTANE                                23
X0011  43201       11.44     16.04  METHANE                                 33
X0011  43202        3.43     30.07  ETHANE                                  43
X0011  43302        6.80     46.07  ETHYL ALCOHOL                           53
X0011  43303       17.76     60.09  N-PROPYL ALCOHOL                        63
X0011  43304        2.39     60.09  ISOPROPYL ALCOHOL                       73
X0011  43351        0.13     74.12  ETHYL ETHER                             83
X0011  43433        2.16     88.10  ETHYL ACETATE                           93
X0011  43452        0.20    132.00  ACETIC ACID 2-ETHOXYETHYL ESTER        103
X0011  43203        0.29     28.05  ETHYLENE                               113
X0011  43205        4.80     42.08  PROPYLENE                              123
X0011  43213        1.94     56.10  N-BUTANE                               133
X0011  43224        1.70     70.13  1-PENTENE                              143
X0011  43502        3.11     30.03  FORMALDEHYDE                           153
X0011  43118       31.00    114.00  MINERAL SPIRITS                        163
X0011  45102        1.14    106.16  XYLENE                                 173
X0011  45202        3.71     92.13  TOLUENE                                183
X0011  43248        1.43     84.16  CYLCOHEXANE                            193
X0011  45106        1.00    134.21  ISOMERS OF DIETHYLBENZENE              203
X0011  45203        0.86    106.16  ETHYLBENZENE                           213
X0011  43301        0.86     32.04  METHYL ALCOHOL                         223
X0011  43305        0.86     74.12  N-BUTYL ALCOHOL                        233
X0011  43435        1.14    116.16  N-BUTYL ACETATE                        243
X0012                     00.00  X0012     METHYL ACETATE                    2
X0012  43432      100.00     74.08  METHYL ACETATE                          13
```

TABLE I-3

DESCRIPTIONS OF NAPAP AREA SOURCE CLASSIFICATION CODES

SCC	SCC Description
99999901	Residential fuel -- anthracite coal
99999902	Residential fuel -- bituminous coal
99999903	Residential fuel -- distillate oil
99999904	Residential fuel -- natural gas
99999905	Residential fuel -- wood
99999906	Commercial/institutional fuel -- anthracite coal
99999997	Commercial/institutional fuel -- bituminous coal
99999908	Commercial/institutional fuel -- distillate oil
99999909	Commercial/institutional fuel -- residiual oil
99999910	Commercial/institutional fuel -- natural gas
99999911	Commercial/institutional fuel -- wood
99999912	Industrial fuel -- anthracite coal
99999913	Industrial fuel -- bituminous coal
99999914	Industrial fuel -- distillate oil
99999915	Industrial fuel -- residual oil
99999916	Industrial fuel -- natural gas
99999917	Industrial fuel -- wood
99999918	Onsite incineration -- residential
99999919	Onsite incineration -- industrial
99999920	Onsite incineration -- commercial/institutional
99999921	Open burning -- residential
99999922	Open burning -- industrial
99999923	Open burning -- commercial/institutional
99999924	Light duty gasoline vehicles -- rural roads
99999925	Light duty gasoline vehicles -- urban roads
99999926	Medium duty gasoline vehicles -- rural roads
99999927	Medium duty gasoline vehicles -- urban roads
99999928	Heavy duty gasoline vehicles -- rural roads
99999929	Heavy duty gasoline vehicles -- urban roads
99999930	Off highway gasoline vehicles
99999931	Heavy duty diesel vehicles -- rural roads
99999932	Heavy duty diesel vehicles -- urban roads
99999933	Off highway diesel vehicles
99999934	Railroad locomotives
99999935	Aircraft LTOs -- military
99999936	Aircraft LTOs -- civil
99999937	Aircraft LTOs -- commercial
99999938	Vessels -- diesel oil
99999939	Vessels -- residual oil
99999940	Vessels -- gasoline
99999941	Solvent purchased
99999942	Gasoline marketed
99999943	Forest wild fires

(continued)

TABLE I-3 (Ctd.)

SCC	SCC Descriptor
99999944	Managed burning — prescribed
99999945	Agricultural field burning
99999946	Structural fires
99999947	Manure field application — beef
99999948	Manure field application — daily cows
99999949	Manure field application — hogs and pigs
99999950	Manure field application — broilers
99999951	Manure field application — other chickens
99999952	Anhydrous NH_3 fertilizer
99999953	Beef cattle feedlots
99999954	Minor point sources

APPENDIX J

EXAMPLE AIR TOXICS EMISSION INVENTORY QUESTIONNAIRE

APPENDIX J

This appendix presents an example of a general questionnaire used for obtaining air toxics emissions data from many kinds of potential sources. This questionnaire is being used as input to simple screening models to determine if a source is a potential problem and if further, more detailed, source, emissions and modeling data are required.

Note in Appendix A of the questionnaire that the compounds of interest (and CAS numbers) are listed, along with de minimis values defining levels of emissions below which a source does not have to report emissions. In this example, these de minimis levels have been determined as a function of acceptable occupational exposure levels.

Dear Sir or Madam:

The Division of   is developing a program to protect human health from the adverse effects of toxic air pollutants. A list of toxic air pollutants which may require regulatory control has been formulated; however, before proceeding any further with development of an air toxics control program, we are conducting a survey to determine which facilities are emitting any of the toxic air pollutants contained in Appendix A and to obtain other essential information for registration purposes.

Attached is a registration form to be filled out by major and minor facilities emitting air pollutants. The registration form is promulgated in accordance with   Code, Subchapter   , Regulation   Please provide the requested information and return the form to the Division within 60 days after receipt.

The registration form was designed to obtain necessary emissions data for toxic air pollutants with a minimum of effort. The registration form consists of a General Information Form, a Source Data Form with preceding instructions, Appendix A entitled "Toxic Air Pollutants", and Appendix B entitled "Division of Environmental Management Regional Offices and Local Air Programs".

All facilities receiving a registration form must complete the General Information Form and the Source Data Form in accordance with the directions. The official signing the facility certification on the General Information Form is responsible for assuring that the registration form has been properly completed. If a facility does not emit any toxic substance listed in Appendix A, the word "NONE" should be entered on the first line of item (3) on the Source Data Form and, together with the completed General Information Form, returned to the Division. Emissions resulting solely from the combustion of wood, coal, natural gas, liquid petroleum gas or unadulterated fuel oil should not be reported. The instructions for completing the Source Data Form also specify emissions which, for the purpose of this registration, are regarded as trace emissions and are not subject to the full reporting requirements.

Any information requested on the registration form which a facility views as confidential should be labeled with the word "CONFIDENTIAL" on the form and documented in a supplementary letter. Confidential information will be treated in accordance with General Statute

If you have any questions or need assistance, please do not hesitate to contact us. Questions should be directed to the regional office responsible for your geographic area as shown in or to the Air Toxics Group located in Your cooperation will be appreciated.

Department of
Division of
Toxic Air Pollutant Source Registration
General Information Form

FACILITY INFORMATION

1. Facility Name ______________________________

2. Facility Address ______________________________
Street Number and Name

____
County City Zip Code

3. Mailing Address (if different than facility address)

____
Street Number and Name or P.O. Box

____
City State Zip Code

4. Existing Air Permit Number(s) ______________________________

5. Primary Four Digit Standard Industrial Classification Number ______________

6. Are there any land surfaces within three miles of your location which are higher than your lowest stack or vented emission point? ______________

7. Does your facility have any fuel burning sources? ______________

8. Facility Contact Person ______________________________

Title ______________________ Telephone Number(   ) ______________
Area Code

FACILITY CERTIFICATION

I certify that the information contained in this registration is true, complete and correct to the best of my knowledge.

____
Authorized Signature Title Date

REGISTRATION SUBMITTAL

This registration form should be completed and transmitted within 60 days after receipt to:

Division of
Air Quality Section

Department of

Division of
Toxic Air Pollutant Source Registration
Instructions For Source Data Form

GENERAL

A Source Data Form must be completed for each emission source at a facility to include stacks, chimneys, vents, fugitive emission sources or other sources that emit any substance listed in Appendix A into the atmosphere. If a facility does not emit any toxic air pollutant listed in Appendix A, then, after filling out the General Information Form the word "NONE" should be entered on the first line of item (3) on the Source Data Form, and both forms returned to the Division.

Source emissions resulting solely from the combustion of wood, coal, natural gas, liquid petroleum gas, or unadulterated fuel oil should not be reported in this registration.

Sources described in Item 1 that emit air pollutants in Appendix A with a maximum source emission rate(s) equal to or less than the emission rate(s) specified in Appendix A for the applicable toxic air pollutant should be identified by entering the word "TRACE" in the applicable column(s) for item (5) but must complete all other applicable items on the Source Data Form excluding Item 6. (The "TRACE" emission rates were derived for the purposes of this registration in order to eliminate unnecessary reporting. An emission rate in excess of a "TRACE" value does not mean that any problem exists.) The emission rates in Appendix A are expressed in "Trace Emission Rate, Pounds/Hour" and "Trace Emission Rate, Pounds/15 Minutes".

Maximum emissions for the 15 minute period should be reported only for those toxic air pollutants in Appendix A having a corresponding value under the column "Trace Emission Rate, Pounds/15 Minutes". If the actual maximum 15 minute trace emission rate is equal to or less than the 15 minute emission rate in Appendix A, then the emission is considered to be a "TRACE" emission.

Emissions of toxic air pollutants identified as "TRACE" will be considered to have an emission rate equal to the applicable emission rate(s) in Appendix A.

SOURCE DATA FORM ITEMS

Item (1) Source Description

Provide a description of the emission source(s) to which the Source Data Form applies. Give the type of source, e.g., incinerator, storage tank, wastewater lagoon, manufacturing building, spray booth, etc., and its designation, e.g., Unit 1, Bldg. A., etc., within the facility.

Facilities may have multiple emission sources to identify which may be combined on one Source Data Form as though it were a single source. In order to do this, the following criteria must be met:

1) The Source Description (Item 1) for each emission source must be the same, excluding the designation (Unit 1, Bldg. A, etc.)

2) The Emission Type (Item 2) must be the same for all emission sources
3) Each different chemical emitted to the atmosphere must be listed in Item 3
4) The Maximum Emissions (Item 5) must be the sum of the emissions from all of the emission sources for each chemical
5) For stacks or vents, the stack or vent parameters in Items 7, 8, 9 and 10 must be the same or nearly the same for the emission sources.

For example, 6 spray booths, 2 of which emit toluene, 3 of which emit xylene, and 1 that emits toluene and xylene all have the same Source Description, the same Emission Type and have nearly the same vent parameters for Items 7 through 10. The entry for Source Description (Item 1) would be "Spray Booths, 6", and if possible, a designation. The entry under Chemical Emitted To Atmosphere (Item 3) would be "Toluene" and "Xylene". The "Maximum Emissions" (Item 5) must be the sum of first, all toluene emissions from the spray booths, and secondly, the sum of all xylene emissions from the spray booths. The vent parameters (Items 7 through 10) should be completed as though a single spray booth were being identified.

Use additional Source Data Forms as necessary.

Item (2) Emission Type

Enter the emission type using the codes at the bottom of the Source Data Form. For the purposes of this registration, the following definitions apply:

A. Unobstructed Vertical Stack or Chimney - Any point in a source designed to emit solids, liquids or gases into the air, including a pipe or a duct but not including flares and that is constructed in a vertical direction and is void of restrictive obstructions, e.g., rain caps.
B. Obstructed or Nonvertical Stack or Chimney - Any point in a source designed to emit solids, liquids or gases into the air, including a pipe or a duct but not including flares and that is either constructed in a nonvertical direction or has a restrictive obstruction, e.g., rain caps.
C. Other Point Source - An identifiable piece of equipment that is used as a complete unit to accomplish a specific purpose or produce a specific product which results in an emission through a vent or functionally equivalent opening excluding stacks or chimneys. Describe the particular point source.
D. Fugitive Emissions - Those emissions which could not reasonably pass through a stack, chimney, vent or other functionally equivalent opening. This includes ponds or lagoons which are used as reservoirs for cooling water, wastewater or other liquid mixtures. Routine leaks entering the atmosphere from pipes, valves, tanks, condensers or other equipment are also considered fugiture emissions and must be reported.
E. Other - All other emission types not identified by A, B, C or D. Describe the particular emission type falling within this category.

Item (3) Chemical Emitted To Atmosphere

List all the chemicals in Appendix A that, for the subject source description, are emitted into the outside atmosphere. For the toxic air pollutants listed as a metal and its compounds, e.g., arsenic and compounds, each individual compound emitted must be identified and addressed individually on the Source Data Form. Use additional Source Data Forms as necessary.

Item (4) CAS Number

Enter the unique number assigned to the chemical listed in Item (3) by the Chemical Abstract Service (CAS). Appendix A lists the CAS number for most of the subject chemicals. CAS numbers may also be obtained from Material Safety Data Sheets. If you are unable to locate a CAS number, contact the Air Toxics Group at

Item (5) Maximum Emissions

List the maximum emission rates for the subject emission source in pounds per hour and in pounds per 15 minutes. The maximum emission rate in pounds per hour is the average hourly emission rate of a maximum daily production excluding startups, shutdowns and malfunctions. The maximum emission rate in pounds per 15 minutes is the maximum emission rate for any given 15 minutes, including startups, shutdowns and malfunctions. Only those chemical emissions having an entry under the column "Trace Emission Rate, Pounds/15 Minutes" in Appendix A should be listed under the 15 minute time period. Stack testing is not advocated as a preferable method for determining the maximum emission rates (or the chemicals in Appendix A emitted into the atmosphere) due to the excessive costs. Mass balancing and other less costly procedures are recommended.

It should be noted that when calculating the maximum emissions from storage tanks, both working losses and breathing losses must be considered. Working losses will be greatest during refilling of tanks when vapor laden air is displaced. Calculations for working loss emissions must include air displacement volume, equilibrium vapor pressure of the liquid stored in the tank, the total absolute pressure of the tank vapor space and the molecular weight of the stored liquid. The following formula or calculations supplied in EPA publication AP-42 titled "Compilation of Air Pollutant Emission Factors", Third Edition, may be used to estimate the working loss emissions:

$$\text{Gas Displacement}(\text{ft}^3/\text{hr}) \times \frac{\text{Equilibrium Vapor Pressure (psia)}}{\text{Total Absolute Pressure (psia)}} = \begin{matrix}\text{Volumetric}\\ \text{Emission Rate}\\ (\text{ft}^3/\text{hr})\end{matrix}$$

Where Gas Displacement = Gallons of Liquid Added Per Hour X 0.134

$$\text{Volumetric Emissions Rate} \times \frac{\text{Molecular Weight of Liquid}}{360} \times \frac{230}{273+{}^{\circ}\text{C}} = \text{Emission Rate (lbs./hr.)}$$

Breathing losses occur independently of any liquid level changes in the tank and are affected by thermal expansion, barometric pressure changes and added vaporization of the liquid. EPA publication AP-42 furnishes calculations for breathing losses.

Item (6) Calculation Method
Enter the letter(s) of the calculation method using the codes at the bottom of the Source Data Form which best describes the method(s) used to determine the emission rates in item (5).

Item (7) Stack or Vent Diameter
Give the inside exit diameter of the stack or vent in feet to the nearest tenth of a foot.

Item (8) Stack or Source Height
Give the actual height in feet above the ground level of the emission outlet. For a fugitive emission, give the height from which the emissions originate.

Item (9) Exit Velocity
Enter the exit velocity in feet per second of the emission at the maximum operating rate.

Item (10) Exit Temperature
Enter the exit temperature in degrees Fahrenheit of the emission outlet at the maximum operating rate.

Department

Division of

Toxic Air Pollutant Source Registration

Source Data Form

(1) Source Description ______________________ (2) Emission Type[1] ______________________

(3)	(4)	(5)		(6)	(7)	(8)	(9)	(10)
Chemical Emitted To Air	CAS Number	Maximum Emissions		Calculation Method[2]	Stack or Vent Diameter (Ft.)	Stack or Source Height (Ft.)	Exit Velocity (Ft./Sec.)	Exit Temperature (°F)
		Lbs./Hr.	Lbs./15 Min.					

[1] Emission Type:
- A. Unobstructed Vertical Stack
- B. Obstructed or Nonvertical Stack
- C. Other Point Source (Specify)
- D. Fugitive Emissions
- E. Other (Specify)

[2] Calculation Method:
- A. AP-42 Emission Factor
- B. EPA Document (give document number)
- C. Estimate (attach related worksheets)
- D. Materials Balance (attach related worksheets)
- E. Test Data (attach related worksheets)
- F. Other Emission Factor (attach description)

QUESTIONNAIRE APPENDIX A

Toxic Air Pollutants

Toxic Air Pollutant	Trace Emission Rate (Pounds/Hour)	Trace Emission Rate (Pounds/15 Minutes)	CAS#
1. Acetaldehyde	1.31	4.94	75-07-0
2. Acetic acid	0.18	0.67	64-19-7
3. Acrolein	0.001	0.01	107-02-8
4. Acrylonitrile	0.03		107-13-1
5. Aluminum and compounds	0.07		
6. Ammonia	0.13	0.49	7664-41-7
7. Aniline	0.07		62-53-3
8. Arsenic and compounds	0.0000002		
9. Asbestos	0.0004*		1332-21-4
10. Aziridine	0.007		151-56-4
11. Benzene	0.0002	1.37	71-43-2
12. Benzidine	0.000000005		92-87-5
13. Benzyl chloride	0.03		100-44-7
14. Beryllium and compounds	0.00001		
15. bis-Chloromethyl ether	0.000004		542-88-1
16. Bromine	0.005	0.03	7726-95-6
17. 1,3-Butadiene	0.16		106-99-0
18. Cadmium and compounds	0.0003		
19. Carbon disulfide	0.21		75-15-0
20. Carbon tetrachloride	0.21		56-23-5
21. Chlorine	0.02	0.16	7782-50-5
22. Chlorobenzene	2.56		108-90-7
23. Chlorofluorocarbons	55.67	173.99	
24. Chloroform	0.36		67-66-3
25. Chloroprene	0.32		126-99-8

* For asbestos, assume 30 fibers greater than 5 microns in length are equivalent to a weight of one nanogram.

QUESTIONNAIRE APPENDIX A (CTD.)

	Toxic Air Pollutant	Trace Emission Rate (Pounds/Hour)	Trace Emission Rate (Pounds/15 Minutes)	CAS#
26.	Chromium and compounds	0.0000001		
27.	Cresol (all isomers)	0.16		1319-77-3
28.	p-Dichlorobenzene	3.29	12.36	106-46-7
29.	Di(2-ethylhexyl)phthalate	0.03		117-81-7
30.	Dimethyl sulfate	0.003		77-78-1
31.	Dioxane	0.65		123-91-1
32.	Dioxins	4.4 X 10^{-11}		1746-01-6
33.	Epichlorohydrin	0.07		106-89-8
34.	Ethylacetate	10.25		141-78-6
35.	Ethylenediamine	0.18		107-15-3
36.	Ethylene dibromide	0.0002		106-93-4
37.	Ethylene dichloride	0.29		107-06-2
38.	Ethylene glycol monoethyl ether	0.13		110-80-5
39.	Ethylene oxide	0.01		75-21-8
40.	Ethyl mercaptan	0.007		75-08-1
41.	Fluorides	0.01		
42.	Formaldehyde	0.01	0.05	50-00-0
43.	Hexachlorocyclopentadiene	0.0007		77-47-4
44.	Hexane	1.31		110-54-3
45.	Hydrazine	0.0007		302-01-2
46.	Hydrochloric acid	0.051		7647-01-0
47.	Hydrofluoric acid	0.01	0.09	7664-39-3
48.	Hydrogen cyanide	0.08		74-90-8
49.	Hydrogen sulfide	0.10	0.38	7783-06-4
50.	Iron pentacarbonyl	0.005	0.02	13463-40-6
51.	Lithium and compounds	0.0001		

QUESTIONNAIRE APPENDIX A (CTD.)

Toxic Air Pollutant	Trace Emission Rate (Pounds/Hour)	Trace Emission Rate (Pounds/15 Minutes)	CAS#
52. Maleic anhydride	0.007		108-31-6
53. Manganese and compounds	0.007	0.05	
54. Mercury and compounds	0.00007		
55. Methyl chloroform	13.91		71-55-6
56. Methylene chloride	2.56		75-09-2
57. Methyl ethyl ketone	4.32	16.20	78-93-3
58. Methyl isobutyl ketone	1.50	5.49	108-10-1
59. Methyl mercaptan	0.007		74-93-1
60. Nickel and compounds	0.000004		
61. Nitric acid	0.03	0.18	7697-37-2
62. Nitrobenzene	0.03		98-95-3
63. N-nitrosodimethylamine	0.00000004		62-75-9
64. Pentachlorophenol	0.003		87-86-5
65. Perchloroethylene	2.45	24.54	127-18-4
66. Phenol	0.13	0.69	108-95-2
67. Phosgene	0.002		75-44-5
68. Phosphine	0.002	0.01	7803-51-2
69. Polychlorinated biphenyls	0.003	0.01	1336-36-3
70. Polycyclic organic matter	0.0000007		
71. Styrene	1.57	7.78	100-42-5
72. Sulfuric acid	0.007		7664-93-9
73. Tetrachloroethane	0.05		79-34-5
74. Tetrahydrofuran	4.32	13.46	109-99-9
75. Toluene	2.74	10.255	108-88-3
76. Toluene diisocyanate	0.0002	0.002	26471-62-5
77. Trichloroethylene	1.97	19.78	79-01-6
78. Vinyl chloride	0.0005		75-01-4
79. Vinylidene chloride	0.14	1.46	75-35-4
80. Xylene (all isomers)	3.18	11.99	1330-20-7

APPENDIX K

EXAMPLE AIR TOXICS PRODUCTION AND USE QUESTIONNAIRE

APPENDIX K

This appendix is an example of a general production and use survey form designed to acquire information on chemical production, storage, and use at facilities. This type of form may be used as a screening survey to determine who should receive more detailed followup questionnaires. Or, it may also be utilized to gather emergency preparedness data. (Note: to conserve space, the long list of chemicals attached to this questionnaire has been deleted.)

To the President or Chief Environmental Officer:

As part of our continuing efforts to improve air quality in the Bureau of Air Pollution Control (Bureau) is now engaged in evaluating the effect of potentially toxic chemical pollutants. The enclosed Chemical Substance Survey is a vital part of that evaluation. We request your full cooperation in this effort.

You are requested to report materials which are stored or produced on site in sufficient quantities that could potentially pose an immediate or chronic threat to off-site life and health, including emissions from accidental releases. In reporting this chemical substance data, do not report chemicals such as those used in laboratory work, or for weed and pest control, or virgin fuels such as coal or oil.

The questionnaire was designed for a wide variety of operations. Accordingly, some sections may not apply to your facility; simply mark those "not applicable." Remember, it is just as important for this inventory to alleviate concerns about the unknowns by documenting that potentially serious hazardous air emissions are not taking place.

If there is insufficient room on Form 2 to record all of the chemical substances to be reported, please make sufficient additional copies of Form 2 before filling it out.

The Bureau further requests that these forms be filled out separately for each plant or facility operated by the company. Please return the completed forms to the Bureau, at the above address, as soon as possible, but no later than

Questions should be referred to

Your cooperation in filling out the questionnaire is greatly appreciated.

Sincerely yours,

COUNTY HEALTH DEPARTMENT
BUREAU OF AIR POLLUTION CONTROL

Chemical Substance Survey

Attached are two survey forms. These survey forms request two kinds of data:

1. General information such as company name and address, plant Standard Industrial Classification (SIC) code, name of the person filling out the form, and general plant description. These data are requested on Form 1. Use one set of forms for each plant. Please fill out and return Form 1 even if you have nothing to report on Form 2.

2. Chemical substance information: We are interested in determining what chemicals or substances are used, made or stored at this site.

   For the purposes of this study, the scope of the survey is being defined as pertaining to chemical substances which have been found to pose a threat to life and health. The enclosed list of chemical substances are of concern to the Health Department. Use Form 2 to report any of these chemicals which are stored or produced on site in sufficient quantities that could potentially pose an immediate or chronic threat to off-site life or health. The chemicals have been grouped into categories, similar to the ones below to assist you in locating the chemicals that you use:

   Acids
   Catalysts and Reagents
   Chemical Intermediates
   Chemical Warfare Agents
   Cyanides
   Flavors and Fragrances
   Fumigants
   General Use Chemicals
   Industrial Gases
   Metals and Compounds
   Monomers or used for organic synthesis
   Pesticide Compounds
   Plasticizing Compounds
   Pharmaceuticals
   Refrigerants
   Solvents
   Miscellaneous Chemicals

   These basic chemical data are to be recorded on Form 2.

Please fill in all data to the maximum extent possible. We will be glad to answer any questions about this form or the information we are requesting. Just call . Return completed forms to:

COUNTY HEALTH DEPARTMENT
BUREAU OF AIR POLLUTION CONTROL

CHEMICAL SUBSTANCE SURVEY

Form 1 - Company Information

Plant/Facility Location

1. Company Name: ____________________

2. Company Address: ____________________

____

3. City/Zip Code ____________________

4. Municipality (or Township) ____________________

5. Telephone Number: ____________________

6. Contact Person - Name: ____________________

Title: ____________________

Mailing information, if different from above:

7. Company Name: ____________________

8. Company Address: ____________________

____

9. City/Zip Code: ____________________

10. Plant SIC code: ____________________

11. Please give a brief, general description of operations at this plant.

____

____

____

____

12. Is there an emergency response program to deal with releases of chemical substance in use or storage on your premises? ____________________

13. If the answer to No. 12 is yes, is the program coordinated with local emergency management agencies (fire and police departments, or other) and if so, which ones? ____________________

____

____

____

14. Give the plant UTM coordinates, if available: ____________________

____

____

15. Federal Employer I.D. Number for plant/facility named in item 1.

____

____

I certify that to the best of my knowledge, the above information is correct.

____
Signature (of person filling out these forms)

____
Name (Type or Print)

____
Title

____
Telephone Number where above person can be reached.

COUNTY HEALTH DEPARTMENT
BUREAU OF AIR POLLUTION CONTROL

Chemical Substance Survey

Form 2 - Instructions

Chemicals/substances in use.

If there is insufficient room on Form 2 to record all of the chemical substances to be reported, please make sufficient additional copies of Form 2 before filling it out. Use this form to report any chemical substances from the enclosed list, that are stored or produced on-site in sufficient quantities that could pose an immediate or chronic threat to off-site life or health, including emissions from accidental releases.

Item 20 - Commercial Name, Common Name, or CAS Name.

Chemical substances should be listed by their most commonly used name. For instance, methyl ethyl ketone (common name) may be referred to as MEK (another common name), 2-Butanone (CAS name) or some commercial name (for example, Jones super solvent). For substances consisting of two or more chemicals, list all known ingredients separately unless there is no information available on the individual ingredients. The CAS name is that name derived from the nomenclature used by the American Chemical Society's Chemical Abstract Service in the 8th Collection Index of Chemical Abstracts.

Item 21 - CAS Number

The Chemical Abstracts Service (CAS) Registry Number is a numeric designation assigned by the American Chemical Society's Chemical Abstracts Service and uniquely identifies a specific chemical compound. This entry allows one to conclusively identify a substance regardless of the name or naming system used. CAS numbers for most of the substances of interest here are on the attached list.

Item 22 - Quantity purchased by the facility annually in pounds.

Give the quantity annually purchased by the facility in pounds. If the chemical substance listed in Item 20 is part of a mixture of other chemicals (such as a solution, suspension, emulsion, etc.), list information only for the designated chemical substance in columns 21 through 26. In column 20, along with the chemical substance name, give pertinent information on the mixture (such as: "stored as a 1/2% solution in mineral oil", or "chemical is 1000 ppm in an inert compressed gas product"). For this item, and for Item 23, the amount reported should be the higher of the following two figures:

1. Average of last three (3) years.
2. Amount used in 1984.

Item 23 - Quantity produced or manufactured annually, in pounds.

Give the quantity produced or manufactured by the facility annually, in pounds.

Item 24 - Maximum quantity stored in the plant at any one time, in pounds.

Item 25 - Indicate by using one or more of the following codes the type of airborne emissions of this substance during the last three years.

A - Accidental (only)
B - During Breakdown
C - Continuous during operations
I - Intermittant
S - During Start-up/Shutdown only
N - There were no air emissions

Item 26 - Indicate with "Yes" if there is air pollution control equipment on the source of emissions and with "No" if there is no air pollution control equipment on the source of emissions. (Note: Emissions control for the substance in question.)

If it is more convenient to report your data in units other than pounds, you may do so. However, we request that you also provide adequate information to convert those units to pounds.

COUNTY HEALTH DEPARTMENT
BUREAU OF AIR POLLUTION CONTROL

Chemical Substance Survey - Form 2
Chemical Substances in Use

Commercial Name, Common Name or CAS Name 20	CAS Number 21	Quantity Purchased Annually (Pounds) 22	Quantity Produced or Manufactured Annually (Pounds) 23	Maximum Quantity Stored in Plant at any one Time (lbs.) 24	Chemical Substance Emissions		
					Type of Emissions Code 25	Air Pollution Control Equip. Yes	No 26

I certify that, to the best of my knowledge, the above information is correct.

Date

Signature

Title

APPENDIX L

GLOSSARY OF CHEMICAL NAME SYNONYMS

APPENDIX L

GLOSSARY OF CHEMICAL NAME SYNONYMS

A brief glossary of common synonyms for the substances addressed in this report is listed in Appendix L. The more frequently used names are listed in the left hand column and synonyms in the right hand column. Other synonyms may exist, but more common ones are listed here. Additional synonyms can be found in the EPA CASR or Chemical Activities Status Report (EPA 560/130-80-040a).

GLOSSARY OF CHEMICAL NAME SYNONYMS[a]

Substance	Synonym
Acetaldehyde	Ethanal
Acrolein	Acrylic aldehyde
Acrylonitrile	Propenenitrile
Allyl chloride	3-Chloropropene
Ammonia	Anhydrous ammonia
Benzene	Benzol, Phenyl hydride
Benzo(a)pyrene	3,4-Benzpyrine
Benzyl chloride	alpha-Chlorotoluene
1,3-Butadiene	Divinyl, Biethylene
Carbon tetrachloride	Tetrachloromethane
Chloroethane	Ethyl chloride, Hydrochloric ether
Chloroform	Trichloromethane
Chloroprene	2-Chloro-1,3-butadiene
Cresol	Cresylic acid
p-Dichlorobenzene	1,4-Dichlorobenzene
Dioxane	Diethylene dioxide, Dioxan, 1,4-Dioxane
Epichlorohydrin	Chloropropylene oxide
Ethylene dibromide	1,2-Dibromoethane
Ethylene dichloride	1,2-Dichloroethane
Ethylene oxide	1,2-Epoxyethane
Formaldehyde	Methylene oxide, Formalin
Hexachlorobenzene	Perchlorobenzene
Maleic anhydride	2,5-Furanedione

GLOSSARY OF CHEMICAL NAME SYNONYMS[a] (Continued)

Substance	Synonym
Methyl bromide	Bromomethane
Methyl chloride	Chloromethane
Methyl chloroform	1,1,1-Trichloroethane
Methyl methacrylate	Methyl ester, Pegalan
Methylene chloride	Dichloromethane
Naphthalene	Naphthalin
Nitrobenzene	Nitrobenzol
Perchloroethylene	Tetrachloroethylene
Phenol	Carbolic acid
Phosgene	Carbonyl chloride, Carbon oxychloride
Phthalic anhydride	PAN
Propylene oxide	1,2-Epoxy propane, Propene oxide
Styrene	Vinyl benzene, Phenyl ethylene
Tetrahydrofuran	Diethylene oxide
Toluene	Toluol, Methyl benzene
Toluene diisocyanate	TDI, 2,4-Tolylene diisocyanate
Freon 113	1,1,2-Trichloro-1,2,2-trifluoroethane
Trichloroethylene	Ethylene trichloride
Xylene	Dimethyl benzene
Vinylidene chloride	1,1-Dichloroethylene
Vinyl chloride	Chloroethylene, Vinyl C monomer

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[a] Based on NIOSH/OSHA Pocket Guide to Chemical Hazards, 1978. DHEW (NIOSH) No. 78-210 and EPA Chemical Activities Status Report, 1980. EPA 560/130-80-040(a).

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-450/4-86-010	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Compiling Air Toxics Emission Inventories		5. REPORT DATE July 1986
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Thomas F. Lahre, U. S. Environmental Protection Agency, and Radian Corporation		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Noncriteria Emissions Section Air Management Technology Branch MD 14 U. S. EPA Research Triangle, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED
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15. SUPPLEMENTARY NOTES

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16. ABSTRACT

This report contains technical materials that will assist state and local control agencies in compiling air toxics emission inventories. It contains a discussion of 1) various considerations that should be made in planning and beginning an inventory and 2) various tools an agency can use to locate potential sources and to estimate emissions therefrom. The appendices contain the data needed to use these inventory tools and some example applications of them.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Air Toxics Emission Inventories Toxic Emissions Screening Inventory Inventory Procedures Hazardous Air Pollutants		

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